

# ENERGY STAR CERTIFIED CLOTHES WASHERS

## ENERGY STAR VS. STANDARD MODELS – THE BENEFITS ARE CLEAR

Clothes washers that have earned the ENERGY STAR use approximately 35% less water and 35% less energy for washing than standard models. The following information details performance requirements, technological features, savings assumptions and savings facts that can be used to promote the benefits of ENERGY STAR.

ENERGY STAR REQUIREMENTS	
PRODUCT TYPE	CURRENT LEVELS <sup>5</sup> (as of Jan. 1, 2011)
ENERGY STAR top and front loading	MEF $\geq$ 2.0 WF $\leq$ 6.0
Federal Standard top and front loading	MEF $\geq$ 1.26 WF $\leq$ 9.5

The latest ENERGY STAR specification became effective on January 1, 2011.

## ENERGY SAVINGS

If all clothes washers sold in the United States were ENERGY STAR certified, the energy cost savings would grow to more than \$5 billion each year and 34 billion pounds of annual greenhouse gas emissions would be prevented, equivalent to the emissions from 3.2 million vehicles.

Over the lifetime of the product, an ENERGY STAR qualified clothes washer saves:

- 2100 kWh and more than 5 million BTUs of natural gas,
- 39,000 gallons of water,
- \$600 over the product's lifetime.<sup>6</sup>

### How Much Does it Cost to Run Your Clothes Washer Each Year?



Source: US EPA ENERGY STAR Program, 2013.

<sup>5</sup> Clothes washer efficiency is measured by the Modified Energy Factor (MEF) and Water Factor (WF). MEF is a comprehensive energy efficiency measurement that considers the energy used to run the washer, heat the water, and run the dryer. The higher the MEF, the more efficient the clothes washer. WF is a measurement of water efficiency that is calculated as gallons of water used per cubic foot of capacity. The lower the WF, the more efficient the clothes washer.

<sup>6</sup> Clothes washer savings estimate includes both savings from the washer (machine, hot water), and dryer (since more efficient washers receive "credit" for spinning more water out of clothes).

## Age of Clothes Washers in the U.S.



18% of U.S. households do not use a clothes washer at home.

Source: Residential Energy Consumption Survey, Energy Information Administration, 2009.

## TECHNOLOGICAL ADVANCES

ENERGY STAR certified clothes washers deliver superior efficiency and performance by incorporating advanced features such as:

- **Multiple configurations** – ENERGY STAR certified clothes washers are available in either front-load or redesigned top-load configurations which both include technical innovations that help save energy and water.
- **Sophisticated wash systems** – ENERGY STAR certified top-load machines clean your clothing just like standard models without wasting water by filling up the tub. Instead, these machines use sophisticated wash systems to cycle clothes through a mixture of water and detergent, allowing the clothes to be scrubbed and cleaned without using excess water or detergent.
- **No central agitator** – Front-load machines tumble clothes through a small amount of water instead of rubbing clothes against an agitator, while advanced top-load machines lift and tumble clothes through a reduced stream of water. Both designs dramatically reduce the amount of hot water and energy used in the wash cycle.
- **High spin speeds** – Efficient motors spin clothes two to three times faster to extract more water. Less moisture in the clothes means less time in the dryer and less energy spent drying clothes.
- **Long live your clothes** – Front-load and advanced top-load clothes washers' sophisticated wash systems use a variety of methods to lift and tumble your laundry, lengthening the life of often-washed items. Additionally, because they are so gentle, many models can safely clean silk, wool and other hand-washables.

## SAVINGS ASSUMPTIONS

EPA uses the following assumptions for ENERGY STAR savings estimates:

- Average life = 11 years
- Average cycles per year<sup>7</sup> = 295
- Annual utility bill savings for ENERGY STAR vs. non-certified models = \$58
- Annual water savings = 3,614 gallons

### Residential Clothes Washer Water Usage Per Load



Source: US EPA ENERGY STAR Program, 2013.

<sup>7</sup> DOE Test Procedure found in 10 CFR part 430, subpart B, appendix J1.

Data table below is an input for the conservation model. Modification of the table is restricted to the data area.

PGMDEV	GPD	AF_YR	Days_Yr	Life_Yrs	Decay_Yr	BMP	Source or Justification
CII Analyst Survey I	2,947	3	365	1	0.00	9	Per Jon Sweeten.
CII Analyst Survey II	2,947	3	365	1	0.00	9	Per Jon Sweeten.
CII Cooling Tower Cond Meter	2,001	2	260	10	0.00	9	Per Jon Sweeten
CII Engineer Survey	6,609	7	365	1	0.00	9	Per Jon Sweeten
CII Flush Valve Kit	22	0	260	5	0.00	9	
CII High-Efficiency Washers	104	0	365	8	0.00	9	
CII Industrial Process Improve	125,385	100	260	5	0.00	9	Life estimate provided by Jon Sweeten
CII Pre-Rinse Spray Head	200	0	365	3	0.00	9	
CII Research and Development	0	0	0	0	0.00	10	
CII ULF Toilets - Dual Flush	30	0	260	25	0.00	9	Ray shows 15 yr life. Board letter used 25.
CII ULF Toilets - Flush Valve	24	0	260	25	0.00	9	Ray shows 15 yr life. Board letter used 25.
CII ULF Toilets - Tank Type	24	0.027	260	25	0.00	9	Ray shows 15 yr life. Board letter used 25.
CII ULF Urinals	49	0	260	30	0.00	9	Ray shows 15 yr life. Board letter used 30.
CII Walkthru Survey	0	0	0	0	0.00	9	
CII Water Broom	137	0	260	3	0.00	9	
CII Water Management Study	64,386	72	260	1	0.00	9	
CII X-Ray Processor	2,858	3	365	5	0.00	9	
CII X-Ray Processor	0	0	0	0	0.00	0	
INT Interest Owed- to Metropolitan	0	0	0	0	0.00	0	
INT Interest Paid	0	0	0	0	0.00	0	
LAND Audits	8,932	10	365	1	0.00	5	Savings factors provided by Alice.
LAND Central Controllers	39,299	44	365	5	0.00	5	Savings factors provided by Alice.
LAND Education - Member Agency	0	0	0	0	0.00	5	Savings factors provided by Alice.
LAND ET Controllers	37	0	365	10	0.00	5	Savings factors provided by Alice.
LAND Irrigation Controllers	0	0	0	0	0.00	5	Savings factors provided by Alice.
LAND Moisture Sensors	0	0	0	0	0.00	5	Savings factors provided by Alice.
LAND Protector del Agua Class	0	0	0	0	0.00	5	
LAND Research and Development	0	0	0	0	0.00	10	
RES Aerators	2	0	365	2	0.60	2	CUWCC guidelines, p. 2-20.
RES Flappers Replaced w/Survey	8	0	365	5	0.00	1	Lifetime estimate from TAB
RES High-Efficiency Washers	14	0	365	12	0.00	6	
RES Irrig Eval with Timers	26	0	365	4	0.60	1	CUWCC guidelines give 25.9 gpd for turf audit + 60% decay.
RES Irrig Eval without Timers	12	0	365	4	0.60	1	CUWCC guidelines give 12.2 gpd for turf audits without timers + 60% decay.
RES Multi-Family Surveys	9	0	365	4	0.30	1	Assume same as SF indoor survey - 12.2
RES Research and Development	0	0	0	0	0.00	10	
RES Showerheads	6	0	365	5	0.30	2	CUWCC gives 20-30% decay rate for showerheads.
RES Showerheads - Distributed	3	0	365	5	0.30	2	Daily savings reduced to account for .55 installation probability.
RES Surveys, Single Family	21	0	365	5	0.30	1	CUWCC gives 21 gpd for untargeted intensive home surveys.
RES Surveys, Single Family-Old	21	0	365	5	0.30	1	
RES Toilet Displacement	4	0	365	5	0.60	1	CUWCC gives 60% decay rate.
RES ULF Toilets - Distribution	31	0	365	20	0.00	14	Weighted regional average: 60% SF, 40% MF
RES ULF Toilets - Rebate	31	0	365	20	0.00	14	Weighted regional average: 60% SF, 40% MF
RES ULFT - Dual Flush Upgrade	6	0	365	20	0.00	14	Based on Assumption of 0.3 GPF Savings (TAB)



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**EDISON**<sup>®</sup>

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# 2014



## HOME ENERGY EFFICIENCY REBATE PROGRAM – REBATE INFORMATION

### HOW TO APPLY ONLINE

#### STEP 1.

**Read** the Terms and Conditions (page 2) and the Rebates and Requirements (pages 3 to 4).

#### STEP 3.

**Install** qualifying product(s) by February 28, 2015. Qualifying product(s) must be installed prior to submitting your application.

#### STEP 2.

**Purchase** qualifying product(s) between January 1, 2014 and December 31, 2014.

#### STEP 4.

**Apply** online at [www.sce.com/HEER](http://www.sce.com/HEER), by February 28, 2015.



### IMPORTANT INFORMATION

Rebates are available for existing single-family homes, attached multi family homes (up to four-plex), condominiums and mobile homes. **New construction homes do not qualify.**

**Rebates for this program are for a limited time only and may be terminated without prior notice.** If all program requirements are met, a rebate check is generally mailed within 6-8 weeks, unless your application is selected for inspection, which may take additional time. Rebates are limited to one of each rebate type per SCE service account. Incomplete applications cannot be processed and will be returned.

**Keep a copy** of your completed application with required documentation (including receipts or home improvement contract) for your records.

Program terms and conditions apply. The Program is funded by California investor-owned utility customers and administered by Southern California Edison under the auspices of the California Public Utilities Commission. California customers are not obligated to purchase any full-fee service or other services not funded by this program. The Program is subject to termination or change without prior notice. © 2014 Southern California Edison. All rights reserved.

**Apply online at [www.sce.com/rebates](http://www.sce.com/rebates) or, call SCE at 1-800-736-4777 for more information.**



### TERMS AND CONDITIONS

By submitting the 2014 Home Energy Efficiency Rebate (HEER) Program Application, I understand and agree to the following:

1. To be eligible for the rebate, all product(s) must be (i) newly purchased, (ii) installed in a fully constructed dwelling in SCE's service area with an active SCE service account at the time of installation ("Installation Address"), and (iii) designed to reduce consumption of energy distributed by SCE to the Installation Address. Additionally, products must meet the requirements specific to each type of product rebate listed in "Rebates and Requirements" on pages 3 to 4 of this Application. All uses herein of the words "install", "installation", or similar phrases shall mean complete installation such that the subject products are fully functional.
2. Qualifying product(s) must be purchased between January 1, 2014 and December 31, 2014 and installed by February 28, 2015.
3. Funds are limited. Applications are accepted on a first-come, first-served basis. The HEER Program may be modified or terminated without prior notice. In the event that rebate terms change, the order/purchase date will be used to determine product eligibility and the application postmark date (or the date the completed online application was received) will be used to determine rebate amount, if any.
4. A complete application must be submitted for each Installation Address; however, one application may request more than one type of rebate for qualifying products installed at the Installation Address. Products can not be installed at a P.O. Box address.
5. Applications may be submitted online or by mail. If submitting application(s) online, the application will not be complete until all required supporting documentation including all appropriate Proof(s) of Purchase are delivered to SCE. Supporting documentation must be received within 30 days of submitting the online application. Only the Customer of Record may submit an application online. If the application is submitted by the landlord or property manager to the Installation Address or by the resident of a sub-metered mobile home, the application must be submitted by mail. If submitting application(s) by mail, each application must be signed by the person claiming the rebate. The application and all other required documentation including all appropriate Proof(s) of Purchase, must be mailed to SCE's Rebate Processing Center, post marked no later than February 28, 2015. The application and all required documentation, including Proofs of Purchase, must be legible.
6. Rebates may be requested in the form of a bill credit or a rebate check. SCE will issue a bill credit, if requested, only if the Customer of Record maintains an active service account for the Installation Address at the time the bill credit is issued. If a rebate check is requested, or if the application is submitted by the Owner of the Property, or if the Customer of Record has closed the service account for the Installation Address (for instance, if the Customer of Record has moved), SCE will issue a rebate check. The rebate check will be issued to the Customer of Record at the Installation Address, unless the application provides an alternative payee and payment address. Rebate checks and bill credits are generally issued six to eight weeks after SCE determines that an application is complete, and all requirements have been met, provided that there are sufficient rebate funds remaining.
7. SCE reserves the right to select any Application for inspection/verification, and to reject any incomplete Applications. If an Application is selected for inspection/verification, additional time may be required before a rebate check is mailed or a bill credit is issued.
8. **If requested, I will allow (or, if I am not a current occupant at the Installation Address, I will arrange for the current occupant to allow) SCE and/or the California Public Utilities Commission (CPUC) representative(s) reasonable access to the Installation Address to verify installation of the qualifying product purchased, either before or after payment of a rebate.** I understand that a rebate will not be paid if the occupant at the Installation Address refuses to participate in any required inspection/verification. I understand that if I (and/or the occupant of the Installation Address) refuse to participate in or fail any required inspection/verification after receiving a rebate, I may be required to repay to SCE the amount of any rebate received (or if a bill credit was issued, the credit may be reversed). The inspection/verification of installation must be scheduled within 30 days of customer contact by SCE. I understand that SCE may contact the qualifying product vendor and/or installer to verify purchase and/or installation and may provide my name and/or address to complete this inspection/verification.
9. I have installed a qualifying product(s) and understand **the energy-efficiency level of the qualifying product(s) determines the rebate amount.** The rebate amount may not exceed the purchase price. I understand that I cannot receive a rebate for the same product from more than one California investor-owned utility or third-party energy efficiency program offering rebates, financing, or other incentives funded with CPUC Public Goods Charge funds.
10. I agree that the selection of qualifying product(s), selection of manufacturer, dealer, supplier and/or installer, and purchase, installation and ownership/maintenance of the qualifying product(s) referenced in this Application are my sole responsibility, and the manufacturer, dealer, supplier or installer of these products is not an agent or representative of SCE.
11. I understand that SCE makes no representations regarding manufacturers, dealers, contractors, materials or workmanship. **I ALSO UNDERSTAND THAT SCE MAKES NO WARRANTY WHETHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR ANY PARTICULAR PURPOSE, USE, OR APPLICATION OF THE PRODUCTS.**
12. I agree that SCE has no liability whatsoever concerning (1) the quality, safety and/or installation of the products, including their fitness for any purpose, (2) the estimated energy savings of the products, (3) the workmanship of any third parties, (4) the installation or use of the products including, but not limited to, effects on indoor pollutants, or (5) any other matter with respect to the 2014 HEER Program. I waive any and all claims against SCE, its parent companies, directors, officers, employees, or agents, arising out of activities conducted by or on behalf of SCE in connection with my Application for any rebate(s) under the 2014 HEER Program. Without limiting the generality of the foregoing, none of such parties shall be liable hereunder for any type of damages, whether direct, or indirect, incidental, consequential, exemplary, reliance, punitive or special damages, including damages for loss of use, regardless of the form of action, whether in contract, indemnity, warranty, strict liability or tort, including negligence of any kind.
13. I am responsible for meeting all 2014 HEER Program requirements and complying with my state/county/city government's, and/or property owner and/or homeowners association requirements (if any) in my area regarding permits, local conditions, restrictions, codes, ordinances, rules, and regulations concerning this installation.
14. If a tenant, I am responsible for obtaining the property owner's permission to install the product(s) for which I am applying for a rebate. My signature on this Application indicates I have obtained this "permission."
15. SCE is not responsible for items lost or destroyed in electronic transmission, the mail, or other transit.
16. SCE utilizes the "Point-of-Sale" method of program delivery for selected products with participating retailers. Under this method, customers will receive applicable rebates instantly at the cash register. Such purchases are not eligible for a second rebate through this Application or the SCE Rebate Processing Center.
17. All responses are kept confidential. However, SCE may disclose information from my response to the CPUC as required by the CPUC
18. **I certify that the information in my rebate application is true and complete, and that the product(s) and/or equipment for which I am requesting a rebate have been installed and meet(s) the requirements in this application. I further certify that the installation has complied with any applicable permitting requirements and, if a contractor performed the installation, that the contractor holds the appropriate license for the work performed.**

**Apply online at [www.sce.com/rebates](http://www.sce.com/rebates) or, call SCE at 1-800-736-4777 for more information.**



## HOME ENERGY EFFICIENCY REBATE PROGRAM – REFRIGERATOR

**All products must be new.** Follow manufacturer installation requirements. Equipment/Materials must meet or exceed all applicable local, state and federal standards, as well as all the following requirements. Provide the information requested for each product installed. Detach and mail in the completed and signed Customer Application Form, with copy(ies) of proof(s) of purchase, and any other required documentation. **An on-site inspection/or verification of the product(s) purchased and installed may be required before the rebate is paid.**



### ENERGY STAR®-QUALIFIED REFRIGERATOR

**\$35  
REBATE**

Useful Life: 14 Years

#### Requirements:

1. Purchase a new ENERGY STAR®-qualified refrigerator, between January 1, 2014 and December 31, 2014.
2. Verify the product appears on [www.energystar.gov](http://www.energystar.gov) (under Find Energy Star Products).
3. Install the qualifying refrigerator by February 28, 2015.
4. The new refrigerator must be the primary refrigerator used in the home.
5. Provided proof of purchase with your application.
6. Limit: One of any type of HEER refrigerator rebate per Installation Address. One rebate per useful life.



### MOST EFFICIENT ENERGY STAR®-QUALIFIED REFRIGERATOR

**\$75  
REBATE**

Useful Life: 14 Years

#### Requirements:

1. Purchase a new qualifying refrigerator that is one of ENERGY STAR's Most Efficient which uses less than or equal to 481 kWh per year **and** is at least 30% more efficient than federal requirements, between January 1, 2014 and December 31, 2014.
2. The product Model Number must appear on the list of qualifying products found at [www.sce.com/rebates](http://www.sce.com/rebates).
3. Install the qualifying refrigerator by February 28, 2015.
4. The new refrigerator must be the primary refrigerator used in the home.
5. Provided proof of purchase with your application.
6. Limit: One of any type of HEER refrigerator rebate per Installation Address. One rebate per useful life.



### DID YOU KNOW...

In Southern California, it costs more to produce electricity in the summer, when energy demand is at its peak, and less to produce electricity in the winter, during periods of lower demand. That's why making a few small changes to your daily routine can help you save energy, money and the environment, especially during the summer months. Start by using your washing machine, dryer, dishwasher, and/or pool pump during off-peak hours—before noon and after 6:00 PM. And installing timers on your electric water heater, lights and sprinklers can give you more control and more savings.



**Apply online at [www.sce.com/rebates](http://www.sce.com/rebates) or, call SCE at 1-800-736-4777 for more information.**



## HOME ENERGY EFFICIENCY REBATE PROGRAM – WATER HEATERS, WASHERS, POOLS

**All water heaters, washers and pool equipment/materials must be new.** Follow manufacturer installation requirements. Equipment/Materials must meet or exceed all applicable local, state and federal standards, as well as all the following requirements. Provide the information requested for each product installed. Detach and mail in the completed and signed Customer Application Form, with copy(ies) of proof(s) of purchase, and any other required documentation. **An on-site verification of the product(s) purchased and installed may be required before the rebate is paid.**



### HYBRID ELECTRIC HEAT PUMP WATER HEATER

**\$200  
REBATE**

**Requirements:**

Useful Life: 10 Years

1. Purchase a new qualifying hybrid electric heat pump water heater between January 1, 2014 and December 31, 2014. **Tankless water heaters do not qualify. Replacing a gas water heater with a hybrid electric heat pump water heater does not qualify.**
2. Make sure the product appears on the list of qualifying products that can be found at [www.sce.com/rebates](http://www.sce.com/rebates).
3. Install the qualifying hybrid electric heat pump water heater by February 28, 2015.
4. Hybrid electric heat pump water heaters must have an energy factor (EF) of **2.0 or greater**. *Note: Look for the EF rating on the specification sheet or on the packaging box; it does not always appear on the label.*
5. Rebate is limited to hybrid electric heat pump water heaters that are 40 gallons or greater.
6. The new qualifying product must replace an existing electric water heater.
7. Proof of purchase must be provided with your application.
8. Limit: One of any type of HEER water heater rebate per Installation Address. One rebate per useful life.



### EFFICIENT ELECTRIC STORAGE WATER HEATER

**\$30  
REBATE**

**Requirements:**

Useful Life: 13 Years

1. Purchase a new qualifying electric storage water heater between January 1, 2014 and December 31, 2014. **Tankless water heaters do not qualify. Replacing a gas water heater with an electric unit does not qualify.**
2. Make sure the product appears on the list of qualifying products that can be found at [www.sce.com/rebates](http://www.sce.com/rebates).
3. Install the qualifying electric storage water heater by February 28, 2015.
4. Electric storage water heater must have an energy factor (EF) of 0.93 or greater. *Note: Look for the EF rating on the specification sheet or on the packaging box; it does not always appear on the water heater label.*
5. Rebate is limited to electric storage water heaters that are 30 gallons or greater.
6. The new qualifying product must replace an existing electric water heater.
7. Proof of purchase must be provided with your application.
8. Limit: One of any type of HEER water heater rebate per Installation Address. One rebate per useful life.



### VARIABLE-SPEED POOL PUMP AND MOTOR

**\$200  
REBATE**

**Requirements:**

Useful Life: 10 Years

1. Purchase a new variable-speed pool pump and motor between January 1, 2014 and December 31, 2014.
2. Install the qualifying variable-speed pool pump and motor by February 28, 2015.
3. Make sure the pool pumps appear on the list of qualifying products that can be found at [www.sce.com/rebates](http://www.sce.com/rebates).
4. Variable-speed pool pump and motor must be installed in a pre-existing or new in-ground pool. *Note: Pool pumps installed in a spa, jacuzzi or pond do not qualify for a rebate.*
5. The pool pump must be installed at a single family residence.
6. Proof of purchase must be provided with your application.
7. Limit: One variable-speed pool pump and motor rebate per Installation Address. One rebate per useful life.



### ENERGY STAR<sup>®</sup>-QUALIFIED CLOTHES WASHER

**\$50  
REBATE**

**Requirements:**

Useful Life: 11 Years

1. Purchase a new ENERGY STAR qualified clothes washer between January 1, 2014 and December 31, 2014.
2. Make sure the product appears on the list of qualifying products that can be found at [www.sce.com/rebates](http://www.sce.com/rebates).
3. Install the qualifying clothes washer by February 28, 2015.
4. The ENERGY STAR qualified clothes washer must have a modified energy factor (MEF) of 2.0 or greater AND a water factor (WF) of 6.0 or less.
5. Rebate is limited to SCE residential customers who are currently using an **electric water heater**.
6. Proof of purchase must be provided with your application.
7. Limit: One ENERGY STAR qualified clothes washer rebate per Installation Address. One rebate per useful life.



**Apply online at [www.sce.com/rebates](http://www.sce.com/rebates) or, call SCE at 1-800-736-4777 for more information.**

**If you are not able to, or choose not to submit your application at [www.sce.com/rebates](http://www.sce.com/rebates)  
You can choose to apply using one of the following options:**

- **Email [HeerApplication@sce.com](mailto:HeerApplication@sce.com) to receive an automated response with the mail-in application.**
- **Request a mail-in application by calling 1-800-736-4777**

### SAVINGS OPPORTUNITY OVERVIEW

Our energy efficiency programs aren't the only way SCE can help. SCE's other programs include:

#### **Refrigerator and Freezer Recycling**

There's an incentive for turning in your working appliances. To schedule your FREE pickup today, call toll-free, **1-800-234-9722**, or go to **[www.sce.com/pickup](http://www.sce.com/pickup)**. (Monday–Friday, 7 AM to 6 PM, and Saturday, 7 AM to 3:30 PM)

#### **California Solar Initiative (CSI)**

Keeping the environment clean one day at a time. For more information, contact us at **1-866-584-7436** (technical questions) or **1-800-799 4177** (general questions).

#### **Home Energy Advisor**

Helping you identify additional ways to save. Complete the online questionnaire at **[www.sce.com/homeadvisor](http://www.sce.com/homeadvisor)** for more information.

#### **California Alternate Rates for Energy (CARE)**

You can receive a discount of approximately 30% or more on your monthly electric bill, if you meet this program's income qualifications.

#### **Family Electric Rate Assistance (FERA)**

If you have three or more individuals in your household, and you exceed your baseline electricity usage by over 30%, you can receive a discount on your energy bill by meeting the program's income requirements.

#### **Energy Savings Assistance Program**

Receive FREE energy-saving appliances, and benefit from energy-saving services, if you meet the program's eligibility and income requirements (may not be available in all areas). For more information, please visit **[www.sce.com/ESAP](http://www.sce.com/ESAP)**.

#### **Energy Assistance Fund (EAF)**

SCE helps our residential customers by providing you with up to \$100 toward your SCE energy bill, if you meet the program's income qualifications. This assistance is available to you once during a 12-month period.

#### **Medical Baseline**

If you use electrically-powered medical equipment, or if you have specific medical conditions, your household may qualify for an additional baseline energy allowance to help manage your energy costs.

#### **Level Pay Plan (LPP)**

Let SCE help you plan and budget your funds more efficiently by dividing your SCE bill annual energy charges into equal monthly payments.

#### **Payment Arrangements & Extensions**

If you are having difficulty paying your SCE bill, contact us to request a payment extension. We can also help you work out a more flexible payment arrangement.

#### **Budget Assistant**

With Budget Assistant, you can monitor your electricity costs before you receive your next bill. Just set a monthly spending goal and SCE will update you by e-mail, text or voice message alerts weekly, or when you're projected to exceed your goal. Enroll at **[www.sce.com/MyAccount](http://www.sce.com/MyAccount)**.

For more information about these programs, please visit **[www.sce.com/billhelp](http://www.sce.com/billhelp)**.

**Apply online at [www.sce.com/rebates](http://www.sce.com/rebates) or, call SCE at 1-800-736-4777 for more information.**



## 2014 RESIDENTIAL REBATE PROGRAM

Cash rebates are available for existing single-family detached homes, attached homes (up to four-plex), condominiums and mobile homes. **New construction homes do not qualify.**

### How to Apply

1. **Read** the Terms and Conditions included in this application package. To find out whether funds are still available, visit us at [socalgas.com](http://socalgas.com) (search "REBATES") or call 1-888-431-2226. Funding is limited. This program shall at all times be subject to change or termination without prior notice.
2. Qualifying product(s) must be installed between January 1, 2014 and December 31, 2014 to be eligible for a rebate. Do it yourself, or hire a licensed contractor for the installation of energy-efficient qualifying product(s). Please refer to the 'Specification Sheet Product Form' for qualifying product requirements. Qualifying product(s) must be installed prior to submitting a rebate application. **THESE PURCHASES AND INSTALL DATES WILL END EARLIER IF FUNDS ARE DEPLETED.**
3. **Complete** the **Rebate Application Form and Product Form**. Mail the completed forms along with a copy of a recent Southern California Gas Company (SoCalGas®) bill\* and **paid receipt(s)**/proof of purchase (see Proof of Purchase Requirements - Page 2) to:

**Southern California Gas Company  
2014 Residential Rebate Program  
3800 Watt Avenue, Suite 105  
Sacramento, CA 95821**

**All submitted applications must be postmarked December 31, 2014, or earlier, to be eligible for a rebate. ALL applications are processed on a first-come, first-served basis, upon receipt, until funds are depleted. INCOMPLETE and INCORRECT APPLICATIONS CANNOT BE PROCESSED. Resubmitted applications are processed on a first-come, first served basis upon the new receipt date.**

4. **Keep a copy** of all mailed forms and required documents (including receipts and Home Improvement Contracts) for your records.
5. Be prepared to participate in any required verification of installation(s). SoCalGas may verify the energy-efficient product(s), customer eligibility and installation prior to payment of rebate.
6. If all program requirements are met, a rebate check is generally mailed within 6-8 weeks, unless your application is selected for verification, which may take additional time.

**\* Proof of Property Ownership from owner, and a copy of a recent SoCalGas bill from the tenant are required when owner has purchased and installed measure in a rental home. Name and address shown on Proof of Ownership must match name and install address listed on the application form, and address shown on SoCalGas bill must match the install address listed on the application form.**

**Energy Savings Assistance Program and California Alternate Rates for Energy (CARE) Program information:**  
**Before starting your energy-efficiency project, did you know you may qualify for no-cost home improvements through the Energy Savings Assistance Program and/or a 20 percent discount on your monthly energy bills through the CARE program?**  
For more information, visit [socalgas.com](http://socalgas.com) (search "ASSISTANCE"). Or, call 1-800-331-7593 to learn about Energy Savings Assistance Program services and 1-800-427-2200 for CARE program details. By signing this Application you acknowledge that you have read and understand the availability of these services and programs offered by SoCalGas.

**Energy Savings  
Assistance Program™**

## Proof of Purchase Requirements

While you may install some of the products yourself, some should be installed using a licensed contractor. The proof of purchase and other documentation required to process your rebate application may differ depending on who completes the installation. All products must be installed prior to submitting your completed forms and other required documentation.

The following may be used as Proof of Purchase - Home Improvement Contract (HIC) and/or paid invoice/receipts. The California State License Board (CSLB) requires that licensed contractors provide you with a HIC if the materials and labor total for the product(s) and installation is \$500 or more. It is recommended that you request a HIC from your contractor even if the contractor installation was less than \$500. If an HIC is your proof of purchase, it must be the original given to you by your contractor and must be signed and dated by both you and your licensed contractor. If the signatures are not dated, the date that the HIC was written will determine the product purchase date.

### Proof of Purchase must include at least the following information:

1. Retailer/Contractor name, business address and phone.

2. Itemized description of each product, including such information as:
  - a. Manufacturer, product make and model number(s), and other identifying information.
  - b. Insulation level (i.e. R-30), square footage.
  - c. Energy Factor (EF) for natural gas water heaters.
  - d. AFUE for natural gas furnace.
3. Invoice which includes purchase price per product, and notes "Paid in Full" or lists payment terms if applicable.
4. Product installation date, unless self-installed.
5. C.O.D. (cash on delivery) will be accepted as proof of purchase provided C.O.D invoice is accompanied by a delivery receipt, or an install date is noted on the invoice.

Read the Specification Sheet Product Form included in this application to make sure your installed product meets the qualification requirements of the program.

For additional information on Home Improvement Contracts or the status of your contractor's license, visit [cslb.ca.gov](http://cslb.ca.gov) or call the Contractors State License Board at 1-800-321-CSLB (2752).

### Guide for Heating Ventilation and Air Conditioning (HVAC) Systems

#### Step 1: Focus on Quality Installation

How well your heating, ventilation, and air conditioning (HVAC) system performs, and how much it costs to operate, depend in part on the proper installation of the system. Improper HVAC installation may cost more in the long run – using more electricity, running up your bill, and making your air conditioning work harder, which can shorten equipment life. Common installation problems such as low air flow, improper charge or duct leakage can reduce the efficiency and capacity of your air conditioner.

#### Step 2: Contractor Selection:

Hiring a licensed contractor who obtains the required building permit and has knowledge of, and complies with, local codes, ordinances and the requirements of the Building Energy-Efficiency Standards (State Administrative Code, Title 24, Part 6 [www.bsc.ca.gov](http://www.bsc.ca.gov) (search "CODES")) increases the likelihood that your system will be properly installed and will work efficiently, quietly and safely.

Licensed contractors, in general:

- Have a minimum of 4 full years of experience performing the trade
- Have taken a law and trade exam
- Are required to have a contractors bond

- Have been the subject of a background check
- Are regulated by the Contractors State License Board.

Installers who perform contracting work without having a license have avoided these quality assurance requirements and, in addition, may be in violation of the law.

#### Step 3: Quality Assurance

Cities and counties inspect a sample of projects when a construction permit is issued. A building permit, issued by a local authority may be required for HVAC installations and modifications including, but not limited to, the following:

- New HVAC installation
- HVAC change out/remodel/replacement including the air handler, coil, furnace or condenser
- Relocation of an existing HVAC unit
- Removal of an HVAC unit or system
- Adding ducting.

The installation of the equipment may be inspected by a Building Inspector who will perform a quality assurance check that may include ensuring:

- The system is installed to comply with all applicable state, and county or city codes
- The work specified under the permit has been performed properly
- Required compliance documents have been submitted.

Please complete, sign and include this application form with submitted documents.

### REQUIRED CUSTOMER INFORMATION

<b>Metering Status:</b>	<input type="checkbox"/> Individual	<input type="checkbox"/> Master-metered	<input type="checkbox"/> Mobile Home (sub-metered)	
<b>Property Type:</b>	<input type="checkbox"/> Detached Home (Single Family)	<input type="checkbox"/> Attached Home (up to four-plex)	<input type="checkbox"/> Condominium	<input type="checkbox"/> Mobile Home
<b>Check One:</b>	<input type="checkbox"/> Owner Occupied		<input type="checkbox"/> Renter Occupied	

First and Last Name (as it appears on your SoCalGas bill/Proof of Ownership)		SoCalGas Account # (located below name on SoCalGas bill)		
Install Address	Unit Number	City	State	ZIP code
Mailing Address ( )	Unit Number	City	State	ZIP code
Daytime Phone Number	Email address			
Partnership:	Purchased from (retailer):			

### FILL OUT THIS SECTION IF CHECK GOES TO NAME AND MAILING ADDRESS DIFFERENT FROM ABOVE.

Complete this section only if payment is going to someone other than the SoCalGas account holder in the section above. I am authorizing this payment of my rebate to the third party ("Payee") named below and I understand that I will not be receiving the rebate check from SoCalGas. If "Payee" is a business, requested tax information must be provided. I also understand that my release of the payment to the third party does not exempt me from the rebate requirements outlined in this application.

Payee (First and Last Name)	Mailing Address
<b>Tax Status (if business):</b> <input type="checkbox"/> Corporation <input type="checkbox"/> Non-Corporation <input type="checkbox"/> Exempt (i.e. Tax Exempt, Non-Profit)	<b>Federal Tax ID or SSN:</b>

### TERMS AND CONDITIONS READ AND SIGN BELOW

- To be eligible for a rebate, I understand that: (a) I must be a residential customer on a residential rate with an active meter serviced by Southern California Gas Company (SoCalGas) for the installation address and, (b) the product(s) I have installed must qualify as described on the Specification Sheet incorporated herein by this reference and be designed to reduce my consumption of the energy distributed to me by SoCalGas at the installation address above. I understand I must complete a separate application for each installation address for which I am requesting a rebate. All uses herein of the words "install", "installation" or similar phrases shall mean complete installation such that the subject products are fully functional.
- I understand the rebate offer is limited to residential customers for residential use. The energy-efficient product(s) must be installed in a residential dwelling within SoCalGas' service area. **The dwelling unit must be fully constructed and occupied.**
- I understand the program term is January 1, 2014 through December 31, 2014, or sooner, if allocated funds are depleted. Product purchases and installations made prior to January 1, 2014 or after December 31, 2014 do not qualify for a rebate. Resale products, products leased, rebuilt, rented, received from insurance claims, won as a prize, or new parts installed in existing products do not qualify. Funds are limited **ALL applications are processed on a first-come, first-served basis, upon receipt, until funds are depleted. INCOMPLETE and INCORRECT APPLICATIONS CANNOT BE PROCESSED. Resubmitted applications are processed on a first-come, first-served basis upon the new receipt date. The program may be modified or terminated without prior notice. In the event rebate amounts change during the program period, the order/purchase data and/or application postmark date will be used to determine product eligibility and rebate amount.**
- I understand that a signed and dated Rebate Application Form, completed Product Form incorporated herein by this reference, all appropriate Proof(s) of Purchase, and other required documentation as referenced in this Application Package must be sent to **SoCalGas' Processing Center** postmarked by December 31, 2014 to be considered eligible for payment of a rebate. A rebate check for qualifying product(s) is generally mailed 6 to 8 weeks after SoCalGas receives and approves a completed application, including all required documentation, unless an application is selected for a verification, which may add additional time.
- I will allow, if requested, SoCalGas' and/or California Public Utilities Commission (CPUC) representative reasonable access to my home to verify the installed product I have purchased before a rebate is paid. **I understand that a rebate will not be paid if I refuse to participate in any required verification.** I understand that SoCalGas may contact the qualifying product vendor and/or installer, if needed, to verify purchase and/or installation and may provide my name and/or address to complete this verification.
- I have installed qualifying product(s) and understand the energy-efficiency level of the qualifying product(s) (as defined in the Specification Sheet) determines the rebate amount. The rebate amount cannot exceed the purchase price. I understand that I cannot receive a rebate for the same product or equipment from more than one California investor-owned utility or third party energy efficiency program offering rebates, financing or other incentives funded with CPUC Public Goods Charge funds. **Measures receiving a SoCalGas rebate, instant markdown, at the point-of-sale, or through a Regional Energy Network or Energy Upgrade California™ Home Upgrade, do not qualify for a mail-in or online rebate.**
- I agree that the selection of qualifying product(s), selection of manufacturer, dealer, supplier and/or installer, and purchase, installation and ownership/maintenance of the qualifying product(s) referenced in this Application Package are my sole responsibility, and that my manufacturer, dealer, supplier or installer of these products and measures is not an agent or representative of SoCalGas. I understand that SoCalGas makes no representations regarding manufacturers, dealers, contractors, materials or workmanship. **I ALSO UNDERSTAND THAT SOCALGAS MAKES NO WARRANTY, WHETHER EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR ANY PARTICULAR PURPOSE, USE, OR APPLICATION OF THE PRODUCTS OR MEASURES.** I agree that SoCalGas has no liability whatsoever concerning (1) the quality, safety and/or installation of the products or measures, including their fitness for any purpose, (2) the estimated energy savings of the products or measures, (3) the workmanship of any third parties, (4) the installation of use of the products or measures including, but not limited to, effects on indoor pollutants, or (5) any other matter with respect to the 2014 Residential Rebate Program. I waive any and all claims against SoCalGas, its parent company, affiliate companies, directors, officers, employees, or agents, arising out of activities conducted by or on behalf of SoCalGas in connection with my application for any rebate(s) under the 2014 Residential Rebate Program. Without limiting the generality of the foregoing, none of such parties shall be liable hereunder for any type of damages, whether direct, indirect, incidental, consequential, exemplary, reliance, punitive, or special damages, including damages for loss of use, regardless of the form of action, whether in contract, indemnity, warranty, strict liability or tort, including negligence of any kind.
- I am responsible for meeting all program requirements and complying with my state/county/city governments, property owner and/or homeowner's association requirements (if any) in my area regarding local conditions, restrictions, codes, ordinances, rules, and regulations covering this installation.
- If a tenant, I am responsible for obtaining the property owner's permission to install the measure for which I am applying for a rebate. My signature on this application indicates I have obtained this permission.
- I understand that **SoCalGas is not responsible for items lost or destroyed in the mail/transit.**

Please use black or blue ink.

**I HAVE READ AND UNDERSTAND THE TERMS AND CONDITIONS. I CERTIFY THAT THE INFORMATION I HAVE PROVIDED IS TRUE AND CORRECT AND THE PRODUCT(S) FOR REBATE ARE INSTALLED AND OPERATIONAL AND MEETS THE REQUIREMENTS IN THIS APPLICATION.**

As applicable:

☐ By checking this box, I certify I am a licensed contractor and have followed applicable permitting requirements, as appropriate, for this HVAC installation/replacement.

Sign here:

Contractor Signature

Permit Number

**I HAVE READ AND UNDERSTAND THE ABOVE TERMS AND CONDITIONS. I CERTIFY THAT THE INFORMATION I HAVE PROVIDED IS TRUE AND CORRECT AND THE PRODUCT(S) AND/OR EQUIPMENT FOR WHICH I AM REQUESTING A REBATE MEET THE REQUIREMENTS IN THIS APPLICATION PACKAGE.**

As applicable:

☐ By checking this box, I confirm that I have used a licensed contractor, as appropriate, and followed applicable permitting requirements for this installation.

Sign here:

Customer Signature

Print Name

Date

Please send this application to: **Southern California Gas Company / 2014 Residential Rebate Program / 3800 Watt Ave., Ste. 105 / Sacramento, CA 95821**



Please complete, sign and include this product form with submitted documents.

Read the accompanying Specification Sheet before purchasing. Provide all the information requested on this rebate form.			
MEASURE	QUANTITY PURCHASED A	REBATE AMOUNT B	REBATE TOTAL A x B
<b>A. 2014 ENERGY STAR®-QUALIFIED CLOTHES WASHERS</b> Qualified clothes washers must meet current minimum ENERGY STAR Standards to receive a \$35 rebate. <b>HIGH-EFFICIENCY CLOTHES WASHER, TIER I</b> Modified Energy Factor (MEF) of 2.4 or greater AND Water Factor (WF) of 4.0 or less - \$50 Rebate. <b>ENERGY STAR 'MOST EFFICIENT', TIER II</b> Modified Energy Factor (MEF) of 3.2 or greater AND Water Factor (WF) of 3.0 or less - \$75 Make and model number must be included with your receipt. Limit one per individual residence. (List of qualifying products are available at <a href="http://energystar.gov/products">energystar.gov/products</a> ).	_____ unit(s)  MEF _____  WF _____  Cubic Feet _____	<b>\$35/unit</b> <b>\$50/unit, Tier I</b> <b>\$75/unit, Tier II</b>  Date Installed: _____  Date Purchased: _____	\$ _____
<b>B. ATTIC INSULATION</b> Attic insulation is eligible for an incentive only if 1) the pre-retrofit insulation level is R-11 or less and 2) there is at least a 24 inch clearance between top of ceiling joist and bottom of ridge board. In addition, the final insulation level must be at least R-30 unless a higher level is specified by local jurisdiction. Attic insulation is feasible only when the attic crawl space is adequate. At the highest peak, clearance between the bottom of the roof rafters and the top of the ceiling joists must be at least 24 inches. If sufficient space is not available for R-30, the final retrofit level must be at least R-19. Garages and other non-living areas do not qualify. Your rebate is based on the amount of insulation actually installed.	_____ sq. ft.  Final R-value _____	<b>\$0.15/sq. ft.</b>  Date Installed: _____  Date Purchased: _____	\$ _____
<b>C. WALL INSULATION</b> Wall insulation is eligible for an incentive as long as existing walls are not currently insulated and are between conditioned living area and unconditioned area. Garages and other non-living areas do not qualify. The installed insulation must achieve a minimum of R-13. If purchasing insulation, remember that your rebate is based on the amount of insulation actually installed.	_____ sq. ft.  Final R-value _____	<b>\$0.15/sq. ft.</b>  Date Installed: _____  Date Purchased: _____	\$ _____
<b>D. 2014 HIGH EFFICIENCY NATURAL GAS STORAGE WATER HEATERS</b> <b>Level 1</b> - High Efficiency Storage Water Heaters that have an Energy Factor (EF) of .62-.66 receive a \$30 rebate. (List of qualifying products available at <a href="http://ahridirectory.org">ahridirectory.org</a> ). <b>Level 2</b> - ENERGY STAR Storage Water Heaters must have an Energy Factor (EF) of 0.67 or greater to receive a \$100 rebate. (List of qualifying products are available at <a href="http://energystar.gov/products">energystar.gov/products</a> ). <b>Make and model number must be included with a copy of your receipt. Limit one per individual residence. The water heater must be 30 gallons or greater. Look for the EF rating on the water heater specification sheet or on the packaging outside the box.</b>	_____ unit(s) EF _____ Gal. _____	<b>Tier I - \$30/unit</b> <b>Tier II - \$100/unit</b>  Date Installed: _____  Date Purchased: _____	\$ _____
<b>E. 2014 ENERGY STAR NATURAL GAS FURNACE</b> <b>ENERGY STAR Central Natural Gas Furnace</b> - Central Natural Gas Furnace, ENERGY STAR with 92-94 percent Annual Fuel Utilization Efficiency (AFUE) receive a \$150.00 rebate. (List of qualifying products are available at <a href="http://energystar.gov/products">energystar.gov/products</a> ). <b>Tier I</b> - Central Natural Gas Furnace with 95 percent or greater Annual Fuel Utilization Efficiency (AFUE) receive a \$200 rebate. <b>Your C-20 contractor will be able to assist you in choosing the qualified equipment. Make, model number and AFUE must be included with a copy of your receipt. Limit one per individual residence.</b> <b>Must check the box above signature line along with permit number and contractor signature, if applicable, for rebate. See page 3.</b>	_____ unit(s) BTU _____ AFUE _____	<b>Energy Star - \$150 unit</b> <b>Tier I - \$200/unit</b>  Date Installed: _____  Date Purchased: _____	\$ _____
<b>An on-site verification of the products purchased and installed may be required before the rebate is paid.</b>		<b>REBATE TOTAL</b>	\$ _____



**All clothes washers must be installed with a water heating source using natural gas distributed to the installation address by SoCalGas.** The ENERGY STAR label is your assurance of energy-efficiency performance that exceeds federal standards. When used properly, ENERGY STAR-qualified products use less energy than standard equipment, they cost less to operate, and create less pollution. For product retailer listings, visit [energystar.gov](http://energystar.gov).

**Additional rebates from other utilities:** Your local electric and water utilities may also offer energy-efficiency rebates. In some cases, they may be combined with rebates from SoCalGas for even greater savings.

**Measures receiving a SoCalGas rebate, instant markdown, at the point-of-sale, or through a Regional Energy Network or Energy Upgrade California™ Home Upgrade, do not qualify for a mail-in or online rebate.**

look for



WaterSense® Labeled

# Showerheads

Showering is one of the leading ways we use water in the home, accounting for nearly 17 percent of residential indoor water use. For the average family, that adds up to nearly 40 gallons per day. That's nearly 1.2 trillion gallons of water used in the United States annually just for showering, or enough to supply the water needs of New York and New Jersey for a year! By retrofitting your showerheads with WaterSense labeled models, you can save a considerable amount of this water.

## SHOWER WITH POWER

Did you know that standard showerheads use 2.5 gallons of water per minute (gpm)? Showerheads that earn the WaterSense label must demonstrate that they use no more than 2.0 gpm. The WaterSense label also ensures that these products provide a satisfactory shower that is equal to or better than conventional showerheads on the market. The U.S. Environmental Protection Agency (EPA) worked with a variety of stakeholders—including consumers who tested various showerheads—to develop criteria for water coverage and spray intensity. All products bearing the WaterSense label must be third-party certified to ensure they meet EPA water efficiency and performance criteria.

## WATERSENSE SAVINGS

The average family could save 2,900 gallons of water per year by installing WaterSense labeled showerheads. Since these water savings will reduce demands on water heaters, they will also save energy. The average family could save more than 370 kilowatt hours of electricity annually, or the amount it takes to power a house for 13 days. On a national scale, if every home in the United States installed WaterSense labeled showerheads, we could save more than \$2.2 billion in water utility bills and more than 260 billion gallons of water annually. In addition, we could avoid about \$2.6 billion in energy costs for heating water.



WaterSense labeled showerheads could save the average family 2,900 gallons of water per year.

## LOOK FOR THE WATERSENSE LABEL!

Whether you are replacing a showerhead or simply looking for ways to reduce water use and utility bills in your home, look for the WaterSense label when purchasing showerheads to help you identify models that save water and perform well.



In many areas, utilities offer rebates and vouchers that can lower the price of a WaterSense labeled showerhead. For more information or a list of WaterSense labeled products, visit [www.epa.gov/watersense](http://www.epa.gov/watersense).

Analysis of the Energy Intensity of Water Supplies  
for West Basin Municipal Water District

March, 2007

Robert C. Wilkinson, Ph.D.

## Note to Readers

This report for West Basin Municipal Water District is an update and revision of an analysis and report by Robert Wilkinson, Fawzi Karajeh, and Julie Mottin (Hannah) conducted in April 2005. The earlier report, *Water Sources "Powering" Southern California: Imported Water, Recycled Water, Ground Water, and Desalinated Water*, was undertaken with support from the California Department of Water Resources, and it examined the energy intensity of water supply sources for both West Basin and Central Basin Municipal Water Districts. This analysis focuses exclusively on West Basin, and it includes new data for ocean desalination based on new engineering developments that have occurred over the past year and a half.

## Principal Investigator: Robert C. Wilkinson, Ph.D.

Dr. Wilkinson is Director of the Water Policy Program at the Donald Bren School of Environmental Science and Management, and Lecturer in the Environmental Studies Program, at the University of California, Santa Barbara. His teaching, research, and consulting focuses on water policy, climate change, and environmental policy issues. Dr. Wilkinson advises private sector entities and government agencies in the U.S. and internationally. He currently served on the public advisory committee for California's 2005 State Water Plan, and he represented the University of California on the Governor's Task Force on Desalination.

Contact: [wilkinson@es.ucsb.edu](mailto:wilkinson@es.ucsb.edu)



## West Basin Municipal Water District

**Contact:** Richard Nagel, General Manager  
West Basin Municipal Water District  
17140 South Avalon Boulevard, Suite 210  
Carson, CA 90746  
(310) 217 2411 phone, (310) 217-2414 fax  
[richn@westbasin.org](mailto:richn@westbasin.org)

West Basin Municipal Water District [www.westbasin.org](http://www.westbasin.org)



## Overview

Southern California relies on imported and local water supplies for both potable and non-potable uses. Imported water travels great distances and over significant elevation gains through both the California State Water Project (SWP) and Colorado River Aqueduct (CRA) before arriving in Southern California, consuming a large amount of energy in the process. Local sources of water often require less energy to provide a sustainable supply of water. Three water source alternatives which are found or produced locally and could reduce the amount of imported water are desalinated ocean water, groundwater, and recycled water. Groundwater and recycled water are significantly less energy intensive than imports, while ocean desalination is getting close to the energy intensity of imports.

Energy requirements vary considerably between these four water sources. All water sources require pumping, treatment, and distribution. Differences in energy requirements arise from the varying processes needed to produce water to meet appropriate standards. This study examines the energy needed to complete each process for the waters supplied by West Basin Municipal Water District (West Basin).

Specific elements of energy inputs examined in this study for each water source are as follows:

- Energy required to **import water** includes three processes: pumping California SWP and CRA supplies to water providers, treating water to applicable standards; and distributing it to customers.
- **Desalination of ocean water** includes three basic processes: 1) pumping water from the ocean or intermediate source (e.g. a powerplant) to the desalination plant; 2) pre-treating and then desalting water including discharge of concentrate; and 3) distributing water from the desalination plant to customers.
- **Groundwater** usage requires energy for three processes: pumping groundwater from local aquifers to treatment facilities; treating water to applicable standards; and distributing water from the treatment plant to customers. Additional injection energy is sometimes needed for groundwater replenishment.
- Energy required to **recycle water** includes three processes: pumping water from secondary treatment plants to tertiary treatment plants; tertiary treatment of the water, and distributing water from the treatment plant to customers.

The energy intensity results of this study are summarized in the table on the following page. They indicate that recycled water is among the least energy-intensive supply options available, followed by groundwater that is naturally recharged and recharged with recycled water. Imported water and ocean desalination are the most energy intensive water supply options in California. East Branch State Water Project water is close in energy intensity to desalination figures based on current technology, and at some points along the system, SWP supplies exceed estimated ocean desalination energy intensity. The following table identifies energy inputs to each of the water supplies including estimated energy requirements for desalination. Details describing the West Basin system operations are included in the water source sections. Note that the Title 22 recycled water energy figure reflects only the *marginal* energy required to treat secondary effluent wastewater which has been processed to meet legal discharge requirements, along with the energy to convey it to user

### Energy Intensity of Water Supplies for West Basin Municipal Water District

	af/yr	Percentage of Total Source Type	kWh/af Conveyance Pumping	kWh/af MWD Treatment	kWh/af Recycled Treatment	kWh/af Groundwater Pumping	kWh/af Groundwater Treatment	kWh/af Desalination	kWh/af WBMWD Distribution	Total kWh/af	Total kWh/year
<b>Imported Deliveries</b>											
State Water Project (SWP) <sup>1</sup>	57,559	43%	3,000	44	NA	NA	NA	NA	0	3,044	175,209,596
Colorado River Aqueduct (CRA) <sup>1</sup> (other than replenishment water)	76,300	57%	2,000	44	NA	NA	NA	NA	0	2,044	155,957,200
<b>Groundwater<sup>2</sup></b>											
natural recharge	19,720	40%	NA	NA	NA	350	0	NA	0	350	6,902,030
replenished with (injected) SWP water <sup>1</sup>	9,367	19%	3,000	44	NA	350	0	NA	0	3,394	31,791,598
replenished with (injected) CRA water <sup>1</sup>	11,831	24%	2,000	44	NA	350	0	NA	0	2,394	28,323,432
replenished with (injected) recycled water	8,381	17%	205	0	790	350	0	NA	220	1,565	13,116,278
<b>Recycled Water</b>											
West Basin Treatment, Title 22	21,506	60%	205	NA	0	NA	NA	NA	285	490	10,537,940
West Basin Treatment, RO	14,337	40%	205	NA	790	NA	NA	NA	285	1,280	18,351,360
	35,843										
<b>Ocean Desalination</b>	20,000	100%	200	NA	NA	NA	NA	3,027	460	3,687	82,588,800

Notes:

NA Not applicable

<sup>1</sup> Imported water based on percentage of CRA and SWP water MWD received, averaged over an 11-year period. Note that the figures for imports do not include an accounting for system losses due to evaporation and other factors. These losses clearly exist, and an estimate of 5% or more may be reasonable. The figures for imports above should therefore be understood to be conservative (that is, the actual energy intensity is in fact higher for imported supplies than indicated by the figures).

<sup>2</sup> Groundwater values include entire basin, West Basin service area covers approximately 86% of the basin. Groundwater values are specific to aquifer characteristics, including depth, within the basin.



## Energy Intensity of Water

Water treatment and delivery systems in California, including extraction of “raw water” supplies from natural sources, conveyance, treatment and distribution, end-use, and wastewater collection and treatment, account for one of the largest energy uses in the state.<sup>1</sup> The California Energy Commission estimated in its 2005 Integrated Energy Policy Report that approximately 19% of California’s electricity is used for water related purposes including delivery, end-uses, and wastewater treatment.<sup>2</sup> The total energy embodied in a unit of water (that is, the amount of energy required to transport, treat, and process a given amount of water) varies with location, source, and use within the state. In many areas, the energy intensity may increase in the future due to limits on water resource extraction, and regulatory requirements for water quality, and other factors.<sup>3</sup> Technology improvements may offset this trend to some extent.

*Energy intensity* is the total amount of energy, calculated on a whole-system basis, required for the use of a given amount of water in a specific location.

### The Water-Energy Nexus

Water and energy systems are interconnected in several important ways in California. Water systems both provide energy – through hydropower – and consume large amounts of energy, mainly through pumping. Critical elements of California’s water infrastructure are highly energy-intensive. Moving large quantities of water long distances and over significant elevation gains, treating and distributing it within the state’s communities and rural areas, using it for various purposes, and treating the resulting wastewater, accounts for one of the largest uses of electrical energy in the state.<sup>4</sup>

Improving the efficiency with which water is used provides an important opportunity to increase related energy efficiency. (“*Efficiency*” as used here describes the useful work or service provided by a given amount of water.) Significant potential economic as well as environmental benefits can be cost-effectively achieved in the energy sector through efficiency improvements in the state’s water systems and through shifting to less energy intensive local sources. The California Public Utilities Commission is currently planning to include water efficiency improvements as a means of achieving energy efficiency benefits for the state.<sup>5</sup>

### Overview of Energy Inputs to Water Systems

There are four principle energy elements in water systems:

1. primary water extraction and supply delivery (imported and local)
2. treatment and distribution within service areas
3. on-site water pumping, treatment, and thermal inputs (heating and cooling)



#### 4. wastewater collection, treatment, and discharge

Pumping water in each of these four stages is energy-intensive. Other important components of embedded energy in water include groundwater pumping, treatment and pressurization of water supply systems, treatment and thermal energy (heating and cooling) applications at the point of end-use, and wastewater pumping and treatment.<sup>6</sup>

##### **1. Primary water extraction and supply delivery**

Moving water from near sea-level in the Sacramento-San Joaquin Delta to the San Joaquin-Tulare Lake Basin, the Central Coast, and Southern California, and from the Colorado River to metropolitan Southern California, is highly energy intensive.

Approximately 3,236 kWh is required to pump one acre-foot of SWP water to the end of the East Branch in Southern California, and 2,580 kWh for the West Branch. About 2,000 kWh is required to pump one acre foot of water through the CRA to southern California.<sup>7</sup> Groundwater pumping also requires significant amounts of energy depending on the depth of the source. (Data on groundwater is incomplete and difficult to obtain because California does not systematically manage groundwater resources.)

##### **2. Treatment and distribution within service areas**

Within local service areas, water is treated, pumped, and pressurized for distribution. Local conditions and sources determine both the treatment requirements and the energy required for pumping and pressurization.

##### **3. On-site water pumping, treatment, and thermal inputs**

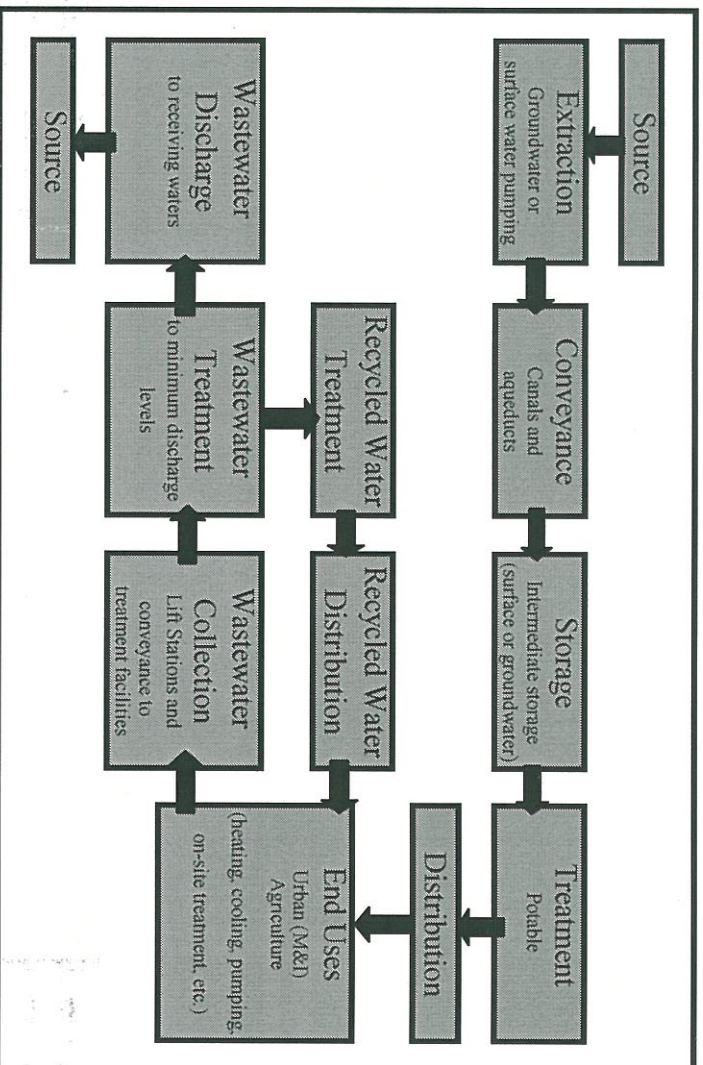
Individual water users use energy to further treat water supplies (e.g. softeners, filters, etc.), circulate and pressurize water supplies (e.g. building circulation pumps), and heat and cool water for various purposes.

##### **4. Wastewater collection, treatment, and discharge**

Finally, wastewater is collected and treated by a wastewater authority (unless a septic system or other alternative is being used). Wastewater is often pumped to treatment facilities where gravity flow is not possible, and standard treatment processes require energy for pumping, aeration, and other processes. (In cases where water is reclaimed and re-used, the calculation of total energy intensity is adjusted to account for wastewater as a *source* of water supply. The energy intensity generally includes the additional energy for treatment processes beyond the level required for wastewater discharge, plus distribution.)

The simplified flow chart below illustrates the steps in the water system process. A spreadsheet computer model is available to allow cumulative calculations of the energy inputs embedded at each stage of the process. This methodology is consistent with that applied by the California Energy Commission in its analysis of the energy intensity of water.

## Simplified Flow Diagram of Energy Inputs to Water Systems



Source: Robert Wilkinson, UCSB<sup>8</sup>

## Calculating Energy Intensity

Total energy intensity, or the amount of energy required to facilitate the use of a given amount of water in a specific location, may be calculated by accounting for the summing the energy requirements for the following factors:

- imported supplies
- local supplies
- regional distribution
- treatment
- local distribution
- on-site thermal (heating or cooling)
- on-site pumping
- wastewater collection
- wastewater treatment



Water pumping, and specifically the long-distance transport of water in conveyance systems, is a major element of California's total demand for electricity as noted above. Water use (based on embedded energy) is the next largest consumer of electricity in a typical Southern California home after refrigerators and air conditioners. Electricity required to support water service in the typical home in Southern California is estimated at between 14% to 19% of total residential energy demand.<sup>9</sup> If air conditioning is not a factor the figure is even higher. Nearly three quarters of this energy demand is for pumping imported water.

### **Interbasin Transfers**

Some of California's water systems are uniquely energy-intensive, relative to national averages, due to the pumping requirements of major conveyance systems which move large volumes of water long distances and over thousands of feet in elevation lift. Some of the interbasin transfer systems (systems that move water from one watershed to another) are net energy producers, such as the San Francisco and Los Angeles aqueducts. Others, such as the SWP and the CRA require large amounts of electrical energy to convey water. On *average*, approximately 3,000 kWh is necessary to pump one AF of SWP water to southern California,<sup>10</sup> and 2,000 kWh is required to pump one AF of water through the CRA to southern California.<sup>11</sup>

Total energy savings for reducing the full embedded energy of *marginal* (e.g. imported) supplies of water used indoors in Southern California is estimated at about 3,500 kWh/af.<sup>12</sup> Conveyance over long distances and over mountain ranges accounts for this high marginal energy intensity. In addition to avoiding the energy and other costs of pumping additional water supplies, there are environmental benefits through reduced extractions from stressed ecosystems such as the delta.

## **Imported Water: The State Water Project and the Colorado River Aqueduct**

Water diversion, conveyance, and storage systems developed in California in the 20<sup>th</sup> century are remarkable engineering accomplishments. These water works move millions of AF of water around the state annually. The state's 1,200-plus reservoirs have a total storage capacity of more than 42.7 million acre feet (maf).<sup>13</sup> West Basin receives imported water from Northern California through the State Water Project and Colorado River water via the Colorado River Aqueduct. The Metropolitan Water District of Southern California delivers both of these imported water supplies to the West Basin.

[illegible]

The State Water Project (SWP) is a state-owned system. It was built and is managed by the California Department of Water Resources (DWR). The SWP provides supplemental water for agricultural and urban uses.<sup>14</sup> SWP facilities include 28 dams and reservoirs, 22 pumping and generating plants, and nearly 660 miles of aqueducts.<sup>15</sup> Lake Oroville on the Feather River, the project's largest storage facility, has a total capacity of about 3.5 maf.<sup>16</sup> Oroville Dam is the tallest and one of the largest earth-fill dams in the United States.<sup>17</sup>

# Analysis of the Energy Intensity of Water Supplies for the West Basin Municipal Water District



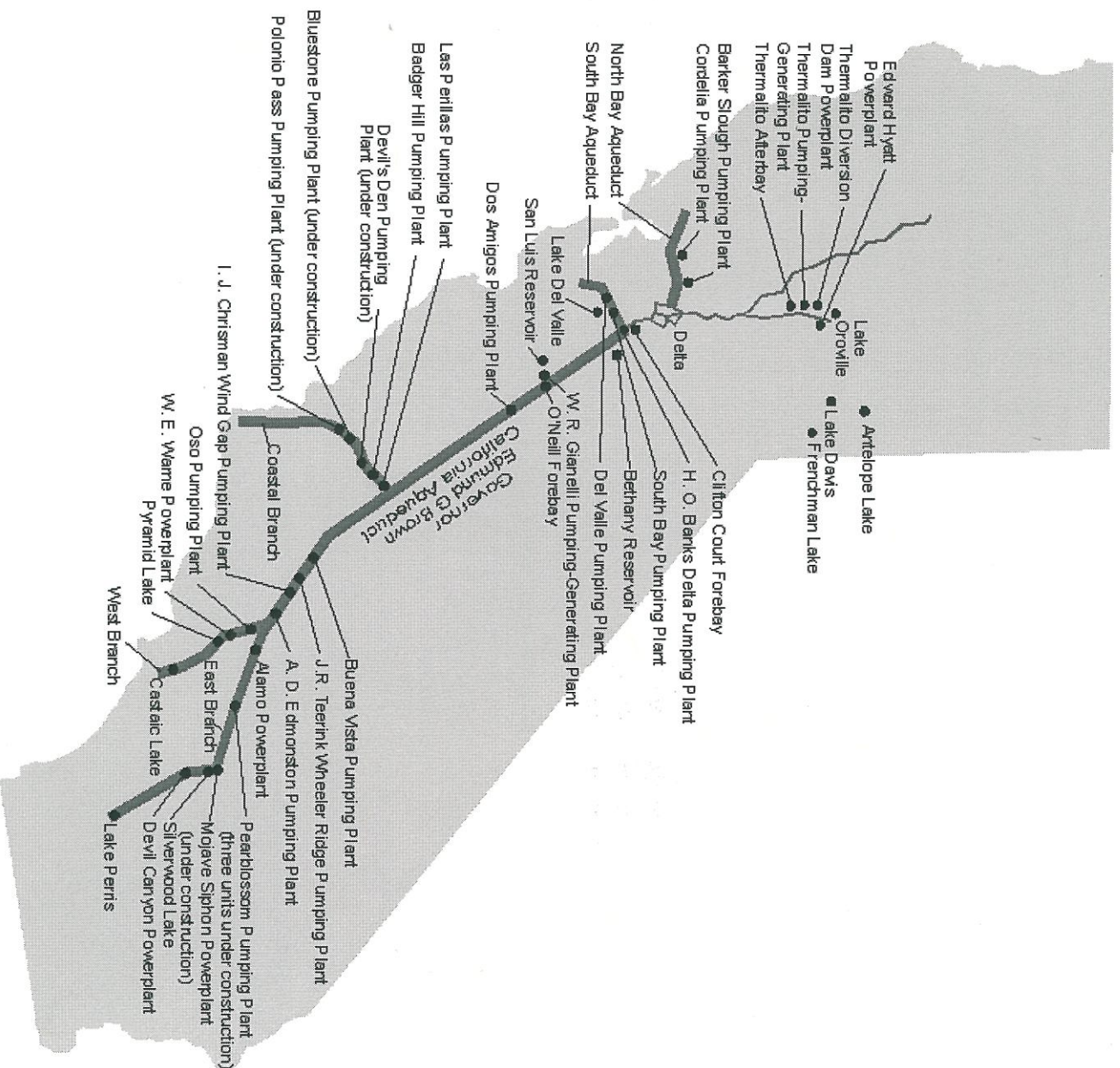
Aqueduct.<sup>18</sup> Further south at the Clifton Court Forebay, water is pumped into Bethany Reservoir by the Banks Pumping Plant. From Bethany Reservoir, the majority of the water is conveyed south in the 444-mile-long Governor Edmund G. Brown California Aqueduct to agricultural users in the San Joaquin Valley and to urban users in Southern California. The South Bay Pumping Plant also lifts water from the Bethany Reservoir into the South Bay Aqueduct.<sup>19</sup>

The State Water Project is the largest consumer of electrical energy in the state, requiring an average of 5,000 GWh per year.<sup>20</sup> The energy required to operate the SWP is provided by a combination of DWR's own hydroelectric and other generation plants and power purchased from other utilities. The project's eight hydroelectric power plants, including three pumping-generating plants, and a coal-fired plant produce enough electricity in a normal year to supply about two-thirds of the project's necessary power.

Energy requirements would be considerably higher if the SWP was delivering full contract volumes of water. The project delivered an average of approximately 2.0 mafy, or half its contracted volumes, throughout the 1980s and 1990s.<sup>21</sup> Since 2000 the volumes of imported water have generally increased.

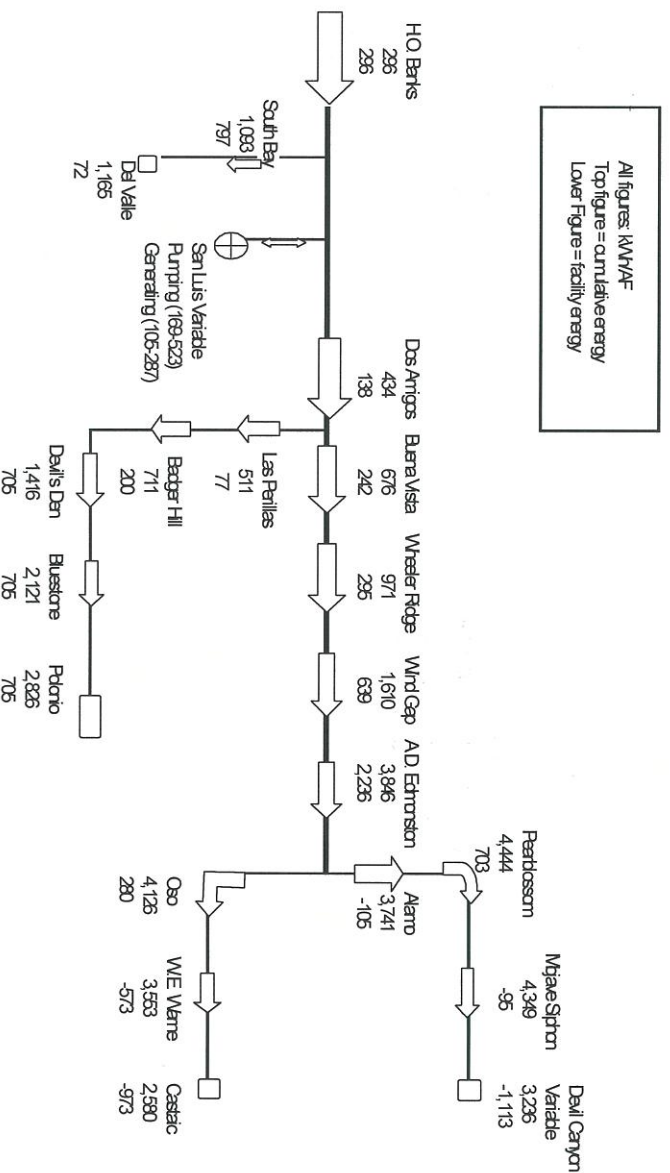
The following map indicates the location of the pumping and power generation facilities on the SWP.

## Names and Locations of Primary State Water Delivery Facilities



The following schematic shows each individual pumping unit on the State Water Project, along with data for both the individual and cumulative energy required to deliver an AF of water to that point in the system. Note that the figures include energy recovery in the system, but they do not account for losses due to evaporation and other factors. These losses may be in the range of 5% or more. While more study of this issue is in order, it is important to observe that the energy intensity numbers are conservative (e.g. low) in that they assume that all of the water originally pumped from the delta reaches the ends of the system without loss.

### State Water Project Kilowatt-Hours per Acre Foot Pumped (Includes Transmission Losses)



Source: Wilkinson, based on data from: California Department of Water Resources, State Water Project Analysis Office, Division of Operations and Maintenance, *Bulletin 132-97*, 4/25/97.



## The Colorado River Aqueduct

Significant volumes of water are imported to the Los Angeles Basin and San Diego in Southern California from the Colorado River via the Colorado River Aqueduct (CRA). The aqueduct was built by the Metropolitan Water District of Southern California (MWD). Though MWD's allotment of the Colorado River water is 550,000 afy, it has historically extracted as much as 1.3 mafy through a combination of waste reduction arrangements with Imperial Irrigation District (IID) (adding about 106,000 afy) and by using "surplus" water.<sup>22</sup> The Colorado River water supplies require about 2,000 kWh/af for conveyance to the Los Angeles basin.

The Colorado River Aqueduct extends 242 miles from Lake Havasu on the Colorado River to its terminal reservoir, Lake Mathews, near Riverside. The CRA was completed in 1941 and expanded in 1961 to a capacity of more than 1 MAF per year. Five pumping plants lift the water 1,616 feet, over several mountain ranges, to southern California. To pump an average of 1.2 maf of water per year into the Los Angeles basin requires approximately 2,400 GWh of energy for the CRA's five pumping plants.<sup>23</sup> On average, the energy required to import Colorado River water is about 2,000 kWh/AF. The aqueduct was designed to carry a flow of 1,605 cfs (with the capacity for an additional 15%).

The sequence for CRA pumping is as follows: The Whitsett Pumping Plant elevates water from Lake Havasu 291 feet out of the Colorado River basin. At "mile 2," Gene pumping plant elevates water 303 feet to Iron Mountain pumping plant at mile 69, which then boosts the water another 144 feet. The last two pumping plants provide the highest lifts - Eagle Mountain, at mile 110, lifts the water 438 feet, and Hinds Pumping Plant, located at mile 126, lifts the water 441 feet.<sup>24</sup>

MWD has recently improved the system's energy efficiency. The average energy requirement for the CRA was reduced from approximately 2,100 kWh/af to about 2,000 kWh/af "through the increase in unit efficiencies provided through an energy efficiency program." The energy required to pump each acre foot of water through the CRA is essentially constant, regardless of the total annual volume of water pumped. This is due to the 8-pump design at each pumping plant. The average pumping energy efficiency does not vary with the number of pumps operated, and MWD states that the same 2,000 kWh/af estimate is appropriate for both the "Maximum Delivery Case" and the "Minimum Delivery Case."<sup>25</sup>

It appears that there are limited opportunities to shift pumping off of peak times on the CRA. Due to the relatively steep grade of the CRA, limited active water storage, and transit times between plants, the system does not generally lend itself to shifting pumping loads from on-peak to off-peak. Under the Minimum Delivery Case, the reduced annual water deliveries would not necessarily bring a reduction in annual peak load, since an 8-pump flow may still need to be maintained in certain months.

Electricity to run the CRA pumps is provided by power from hydroelectric projects on the Colorado River as well as off-peak power purchased from a number of utilities. The Metropolitan Water District has contractual hydroelectric rights on the Colorado River to "more than 20 percent of the firm energy and contingent capacity of the Hoover power plant and 50 percent of the energy and capacity of the Parker power plant."<sup>26</sup> Energy purchased from utilities makes up approximately 25 percent of the remaining energy needed to power the Colorado River Aqueduct.<sup>27</sup>



## Minimizing the Need for Inter-Basin Transfers

For over 100 years, California has sought to transfer water from one watershed for use in another. The practice has caused a number of problems. As of 2001, California law requires that the state examine ways to “*minimize the need to import water from other hydrologic regions*” and report on these approaches in the official State Water Plan.<sup>28</sup> A new focus and priority has been placed on developing *local* water supply sources, including efficiency, reuse, recharge, and desalination. The law directs the Department of Water Resources as follows:<sup>29</sup>

The department, as a part of the preparation of the department's Bulletin 160-03, shall include in the California Water Plan a report on the development of regional and local water projects within each hydrologic region of the state, as described in the department's Bulletin 160-98, to improve water supplies to meet municipal, agricultural, and environmental water needs and *minimize the need to import water from other hydrologic regions*.

(Note that Bulletin 160-03 became Bulletin 160-05 due to a slip in the completion schedule.)

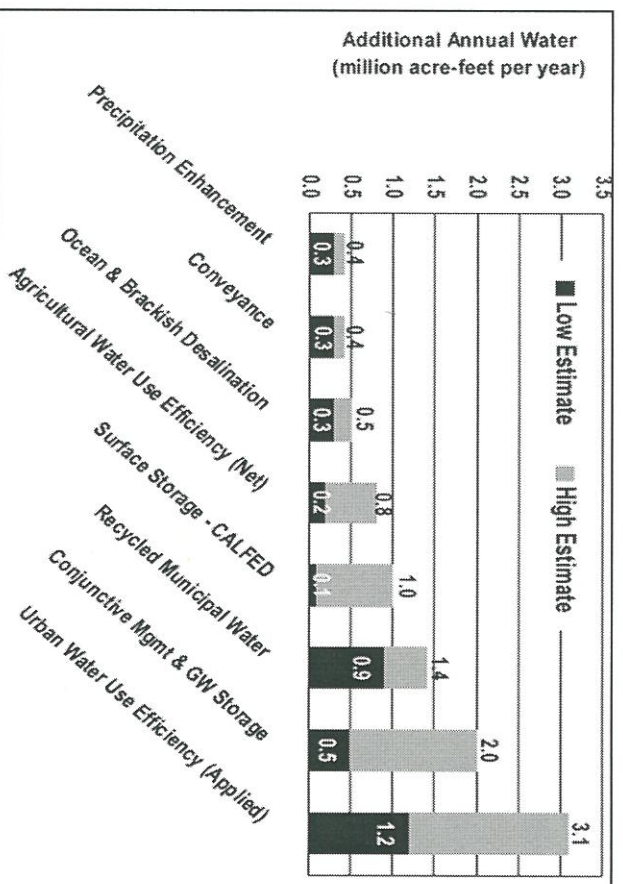
The legislation set forth the range of local supply options to be considered:

The report shall include, but is not limited to, regional and local water projects that use technologies for desalting brackish groundwater and ocean water, reclaiming water for use within the community generating the water to be reclaimed, the construction of improved potable water treatment facilities so that water from sources determined to be unsuitable can be used, and the construction of dual water systems and brine lines, particularly in connection with new developments and when replacing water piping in developed or redeveloped areas.

This law calls for a thorough consideration in the state's official water planning process of work that is already going on in various areas of the state. The significance of the legislation is that for the first time, local supply development is designated as a priority in order to minimize inter-basin transfers.

The Department of Water Resources State Water Plan (Bulletin 160-05) reflects this new direction for the state in its projection of water supply options for the next quarter century. The following graph clearly indicates the importance of local water supplies from various sources in the future.

## California State Water Plan 2005 Water Management and Supply Options for the Next 25 Years



Source: California Water Plan Update 2005.<sup>30</sup>

### Energy Requirements for Treatment of State Water Project and the Colorado River Aqueduct Supplies

Imported SWP and CRA supplies require an estimated 44 kWh/af for treatment before it enters the local distribution systems. Water pressure from MWD's system is sufficient to move supplies through the West Basin distribution system without requiring additional pressure.

### Groundwater and Recycled Water at West Basin MWD

Nearly half of the water used in the service area of the Metropolitan Water District of Southern California (from Ventura to Mexico) is secured from *local* sources, and the percentage of total supplies provided by local sources is growing steadily.<sup>31</sup> This figure is up from approximately one-third of the supply provided by local resources in the mid-1990s.<sup>32</sup> MWD has encouraged local supply development through support for recycling, groundwater recovery, conservation, groundwater storage, and most recently, ocean desalination.



Groundwater and recycled water are important and growing supply sources for West Basin. Water flows through natural hydrologic cycles continuously. The water we use today has made the journey many times. In water recycling programs, water is treated and re-used for various purposes including recharging groundwater aquifers. The treatment processes essentially short-circuit the longer-term process of natural evaporation and precipitation. In cities around the world water is used and then returned to natural water systems where it flows along to more users down stream. It is often used again and again before it flows to the ocean or to a terminal salt sink.

### **Groundwater at West Basin MWD**

Groundwater reservoirs in West Basin are replenished with four water sources: natural recharge, SWP supplies, CRA supplies, and recycled water supplies. The largest portion (approximately 40%) of groundwater supplies is derived from natural recharge. The energy associated with recovering this naturally recharged supply is estimated at 350 kWh/af for groundwater pumping.

Imported water, from both the SWP and CRA, is injected into the groundwater supply in West Basin. The imported water remains at sufficient pressure for injection, so no additional energy is required. The energy requirements for importing water are significant, however, primarily due to the energy associated with importing the water from northern California and the Colorado River. The imported water also passes through MWD's treatment plant, incurring additional energy requirements. The total energy intensity for West Basin's imported water used for recharge of groundwater storage from the SWP is 3,394 kWh/af and from the CRA is 2,394 kWh/af.

Recycled water is also used to recharge groundwater in the basin. West Basin replenishes groundwater by injecting RO treated recycled water from the West Basin Water Recycling Facility (WBWRF). The total energy use is 1,565 kWh/af. Details for the recycled water energy are described in the next section.

### **Recycled Water at West Basin MWD**

Many cities in California are using advanced processes and filtering technology to treat wastewater so it can be re-used for irrigation, industry, and other purposes. In response to increasing demands for water, limitations on imported water supplies, and the threat of drought, West Basin has developed state-of-the-art regional water recycling programs. Water is increasingly being used more than once within systems at both the end-use level and at the municipal level. This is because scarce water resources (and wastewater discharges) are increasing in cost and because cost-effective technologies and techniques for re-using water have been developed that meet health and safety requirements. At the end-use, water is recycled within processes such as cooling towers and industrial processes prior to entering the wastewater system. Once-through systems are increasingly being replaced by re-use technologies. At the municipal level, water re-use has become a significant source of supplies for both landscape irrigation and for commercial and industrial processes. MWD of Southern California is supporting 33 recycling programs in which treated wastewater is used for non-potable purposes.<sup>33</sup>



West Basin provides customers with recycled water used for municipal, commercial and industrial applications. Approximately 27,000 AF of recycled water is annually distributed to more than 210 sites in the South Bay. These sites use recycled water for a wide range of non-potable applications. Based in El Segundo, California, the WBWRF is among the largest projects of its kind in the nation, producing five qualities of recycled water with the capacity at full build-out to recycle 100,000 AF per year of wastewater from the Los Angeles Hyperion Treatment Plant.

In 1998, West Basin began to construct the nation's only regional high-purity water treatment facility, the Carson Regional Water Recycling Facility (CRWRF). A pipeline stretching through five South Bay communities connects the CRWRP to West Basin's El Segundo facility. At the CRWRF, West Basin ultra-purifies the recycled water it gets from the El Segundo facility. From the CRWRF, West Basin uses service lines to transport two types of purified water to the BP Refinery in Carson. The West Basin expansion also includes a new disposal pipeline to carry brine reject water from the CRWRF to a Los Angeles County Sanitation District's outfall.

In order to provide perspective on the energy requirements for the WBWRF, two water qualities and associated energy intensity are presented. "Title 22" water, produced by a gravity filter treatment system, requires conveyance pumping energy from Hyperion to WBWRF at 205 kWh/af. The water flows through the filters via gravity, thus no additional energy is required for treatment. The final energy requirement is 285 kWh/af for distribution with a total energy requirement of 490 kWh/af. This is the lowest grade of recycled water that WBWRF produces. Contrasting the Title 22 water, WBWRF produces RO water with a total energy requirement of 1,280 kWh/af. This includes 205 kWh/af for conveyance from Hyperion, 790 kWh/af for treatment with RO, and 285 kWh/af for distribution.

More than 210 South Bay sites use 9 billion gallons of West Basin's recycled water for applications including irrigation, industrial processes, indirect potable uses, and seawater barrier injection. West Basin has been successful in changing the perception of recycled water from merely a conservation tool with minimal applications to a cost-effective business tool that can reduce costs and improve reliability.

Local oil refineries are major customers for West Basin's recycled water. The Chevron Refinery in El Segundo, the Exxon-Mobile refinery in Torrance, and the BP refinery in Carson use recycled water for cooling towers and in the boiler feed systems.

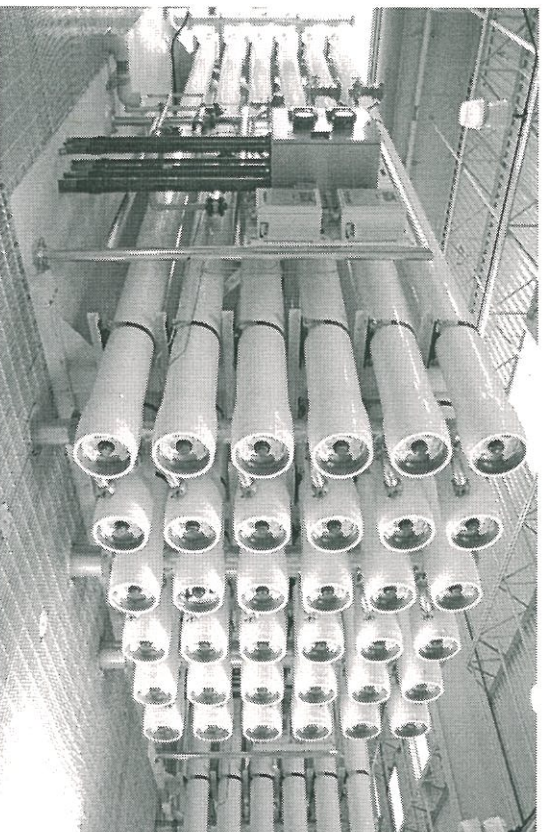
## **Ocean Water Desalination Development**

Desalination technologies are in use around the world. A number of approaches work well and produce high quality water. Many workable and proven technology options are available to remove salt from water. During World War Two, desalination technology was developed as a water source for military operations.<sup>34</sup> Grand plans for nuclear-driven desalination systems in California were drawn up after the war, but they were never implemented due to cost and feasibility problems.



Desalination techniques range from distillation to “reverse osmosis” (RO) technologies. Current applications around the world are dominated by the “multistage flash distillation” process (at about 44% of the world’s applications), and RO, (at about 42%).<sup>35</sup> Other desalting technologies include electrodialysis (6%), vapor compression (4%), multi-effect distillation (4%), and membrane softening (2%) to remove salts.<sup>36</sup> All of the ocean desalination projects currently in place or proposed for municipal water supply in California employ RO technology.

### Reverse Osmosis Membranes



A recent inventory of desalination facilities world-wide indicated that as of the beginning of 1998, a total of 12,451 desalting units with a total capacity of 6.72 afy<sup>37</sup> had been installed or contracted worldwide.<sup>38</sup> (Note that *capacity* does not indicate actual operation.) Non-seawater desalination plants have a capacity 7,620 afd<sup>39</sup>, whereas the seawater desalination plant capacity reached 10,781 afd.<sup>40</sup>

Desalination systems are being used in over 100 countries, but 10 countries are responsible for 75 percent of the capacity.<sup>41</sup> Almost half of the desalting capacity is used to desalt seawater in the Middle East and North Africa. Saudi Arabia ranks first in total capacity (about 24 percent of the world’s capacity) followed by the United Arab Emirates and Kuwait, with most of the capacity being made up of seawater desalting units that use the distillation process.<sup>42</sup>

The salinity of ocean water varies, with the average generally exceeding 30 grams per liter (g/l).<sup>43</sup> The Pacific Ocean is 34-38 g/l, the Atlantic Ocean averages about 35 g/l, and the Persian Gulf is 45 g/l. Brackish water drops to 0.5 to 3.0 g/l.<sup>44</sup> Potable water salt levels should be below 0.5 g/l.

Reducing salt levels from over 30 g/l to 0.5 g/l and lower (drinking water standards) using existing technologies requires considerable amounts of energy, either for thermal processes or for the pressure to drive water through extremely fine filters such as RO, or for some combination of thermal and pressure processes. Recent improvements in energy efficiency have reduced the amount of thermal and pumping energy required for the various processes, but high energy intensity is still an issue. The energy required is in part a function of the degree of salinity and the temperature of the water.

West Basin is in the process of developing plans to construct an ocean desalinating plant. Estimated energy requirements have been calculated by Gerry Filteau of Separation Processes, Inc for each step in the process.<sup>45</sup> The values presented for desalination are based on his work. Since the proposed plant will tap the source water at the power plant, there is no ocean intake pumping required. The source water is estimated to require 200 kWh/af this energy will bring ocean water from the power plant to the desalination system, approximately one quarter of a mile in distance. Pre-treatment of the source water is estimated at 341 kWh/af. This figure includes microfiltration and transfer to the RO units via a 5-10 micron cartridge filter. The RO process requires 2,686 kWh/af if operated at the most energy-efficient level. A slightly less efficient but more cost-effective level of operation would require 2,900 kWh/af, or 214 kWh/af additional energy input according to Filteau. Finally, an estimated 460 kWh/af is required to deliver the product water to the distribution system, including elevation gain, conveyance over distance, and pressurization to 90 psi. No additional energy is required to discharge the brine, as it flows back to the ocean outfall line by gravity.

The energy intensity figures presented here for desalination are lower than previous estimates. This is mainly due to improved membrane technologies, efficiency improvements for high pressure pumps, and pressure recovery systems. It should be noted that the figures provided here are based on engineering estimates, not on actual plant operations.

The total energy required to desalinate the ocean water, including each of the steps above, is estimated to be 3,687 kWh/af. If the energy intensity is increased slightly to improve cost-effectiveness, the total figure increases to 3,901 kWh/af.



## Summary

This study examined the energy intensity of imported and local water supplies (ocean water, groundwater, and recycled water) for both potable and non-potable uses for West Basin. All water sources require pumping, treatment, and distribution. Differences in energy requirements arise from varying pumping, treatment, and distribution processes needed to produce water to meet appropriate standards for different uses.

The key findings of this study are: 1) the marginal energy required to treat and deliver recycled water is among the *least* energy intensive supply options available, 2) naturally recharged groundwater is low in energy intensity, though replenishment with imported water is not, and 3) current ocean desalination technology is getting close to the level of energy intensity of imported supplies.

Further refinement of the data in this study, such as applying an agency's own energy values, may provide a more accurate basis for decision-making tailored to a unique water system. The information presented, however, provides a reasonable basis for water managers to explore energy (and cost) benefits of increased use of local water sources, and it indicates that desalination of ocean water is getting close to the energy intensity of existing supplies.

## Sources

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- <sup>1</sup> Water systems account for roughly 7% of California's electricity use. See Wilkinson, Robert C., 2000. *Methodology For Analysis of The Energy Intensity of California's Water Systems*, and an Assessment of Multiple Potential Benefits Through Integrated Water-Energy Efficiency Measures. Exploratory Research Project, Ernest Orlando Lawrence Berkeley Laboratory, California Institute for Energy Efficiency.
- <sup>2</sup> California Energy Commission, 2005. *Integrated Energy Policy Report*, November 2005, CEC-100-2005-007-CMF.
- <sup>3</sup> Franklin Burton, in a recent study for the Electric Power Research Institute (EPRI), includes the following elements in water systems: "Water systems involve the transportation of water from its source(s) of treatment plants, storage facilities, and the customer. Currently, most of the electricity used is for pumping; comparatively little is used in treatment. For most surface sources, treatment is required consisting usually of chemical addition, coagulation and settling, followed by filtration and disinfection. In the case of groundwater (well) systems, the treatment may consist only of disinfection with chlorine. In the future, however, implementation of new drinking water regulations will increase the use of higher energy consuming processes, such as ozone and membrane filtration." Burton, Franklin L., 1996. *Water and Wastewater Industries: Characteristics and Energy Management Opportunities*. (Burton Engineering) Los Altos, CA, Report CR-106941, Electric Power Research Institute Report, p.3-1.
- <sup>4</sup> Wilkinson, Robert C., 2000. *Methodology For Analysis of The Energy Intensity of California's Water Systems, and an Assessment of Multiple Potential Benefits Through Integrated Water-Energy Efficiency Measures*, Exploratory Research Project, Ernest Orlando Lawrence Berkeley Laboratory, California Institute for Energy Efficiency.
- <sup>5</sup> California Public Utilities Commission, Order Instituting Rulemaking Regarding to Examine the Commission's post-2005 Energy Efficiency Policies, Programs, Evaluation, Measurement and Verification, and Related Issues, Rulemaking 06-04-010 (Filed April 13, 2006)
- <sup>6</sup> An AF of water is the volume of water that would cover one acre to a depth of one foot. An AF equals 325,851 gallons, or 43,560 cubic feet, or 1233.65 cubic meters.
- <sup>7</sup> Metropolitan Water District of Southern California. *Integrated Resource Plan for Metropolitan's Colorado River Aqueduct Power Operations*, 1996, p.5.
- <sup>8</sup> This schematic, based on the original analysis by Wilkinson (2000) has been refined and improved with input from Gary Wolff, Gary Klein, William Kost, and others. It is the basic approach reflected in the CEC IEPR and other analyses.
- <sup>9</sup> QEI, Inc., 1992, *Electricity Efficiency Through Water Efficiency*, Report for the Southern California Edison Company, p. 24.
- <sup>10</sup> Figures cited are *net* energy requirements (gross energy for pumping minus energy recovered through generation).
- <sup>11</sup> Metropolitan Water District of Southern California, *Integrated Resource Plan for Metropolitan's Colorado River Aqueduct Power Operations*, 1996, p.5.
- <sup>12</sup> Wilkinson, Robert C., 2000. *Methodology For Analysis of The Energy Intensity of California's Water Systems, and an Assessment of Multiple Potential Benefits Through Integrated Water-Energy Efficiency Measures*, Exploratory Research Project, Ernest Orlando Lawrence Berkeley Laboratory, California Institute for Energy Efficiency.
- <sup>13</sup> California Department of Finance. California Statistical Abstract. Tables G-2, "Gross Capacities of Reservoirs by Hydrographic Region," and G-3 "Major Dams and Reservoirs of California." January 2001. ([http://www.dof.ca.gov/html/fs\\_data/stat-abs/toc.htm](http://www.dof.ca.gov/html/fs_data/stat-abs/toc.htm))



<sup>14</sup> "The SWP, managed by the Department of Water Resources, is the largest state-built, multi-purpose water project in the country. Approximately 19 million of California's 32 million residents receive at least part of their water from the SWP. SWP water irrigates approximately 600,000 acres of farmland. The SWP was designed and built to deliver water, control floods, generate power, provide recreational opportunities, and enhance habitats for fish and wildlife." California Department of Water Resources, *Management of the California State Water Project*. Bulletin 132-96. p.xix.

<sup>15</sup> California Department of Water Resources, 1996, *Management of the California State Water Project*. Bulletin 132-96.p.xix.

<sup>16</sup> Three small reservoirs upstream of Lake Oroville — Lake Davis, Frenchman Lake, and Antelope Lake — are also SWP facilities. California Department of Water Resources, 1996, *Management of the California State Water Project*. Bulletin 132-96.

<sup>17</sup> California Department of Water Resources, 1996, *Management of the California State Water Project*. Bulletin 132-96. Power is generated at the Oroville Dam as water is released down the Feather River, which flows into the Sacramento River, through the Sacramento-San Joaquin Delta, and to the ocean through the San Francisco Bay.

<sup>18</sup> The North Bay Aqueduct was completed in 1988. (California Department of Water Resources, 1996, *Management of the California State Water Project*. Bulletin 132-96.)

<sup>19</sup> The South Bay Aqueduct provided initial deliveries for Alameda and Santa Clara counties in 1962 and has been fully operational since 1965. (California Department of Water Resources, 1996, *Management of the California State Water Project*. Bulletin 132-96.)

<sup>20</sup> Carrie Anderson, 1999, "Energy Use in the Supply, Use and Disposal of Water in California", Process Energy Group, Energy Efficiency Division, California Energy Commission, p.1.

<sup>21</sup> Average deliveries for 1980-89 were just under 2.0 mafy, deliveries for 1990-99 were just over 2.0 mafy. There is disagreement regarding the ability of the SWP to deliver the roughly 4.2 mafy that has been contracted for.

<sup>22</sup> According to MWD, "Metropolitan's annual dependable supply from the Colorado River is approximately 656,000 AF -- about 550,000 AF of entitlement and at least 106,000 AF obtained through a conservation program Metropolitan funds in the Imperial Irrigation District in the southeast corner of the state. However, Metropolitan has been allowed to take up to 1.3 maf of river water a year by diverting either surplus water or the unused portions of other agencies' apportionments." Metropolitan Water District of Southern California, 1999, "Fact Sheet" at: <http://www.mwd.dst.ca.us/docs/factsheet.htm>.

<sup>23</sup> Metropolitan Water District of Southern California, 1999, <http://www.mwd.dst.ca.us/pr/powres/summ.htm>.

<sup>24</sup> The five pumping plants each have nine pumps. The plants are designed for a maximum flow of 225 cubic feet per second (cfs). The CRA is designed to operate at full capacity with eight pumps in operation at each plant (1800 cfs). The ninth pump operates as a spare to facilitating maintenance, emergency operations, and repairs. Metropolitan Water District of Southern California, 1999, Colorado River Aqueduct. <http://aqueduct.mwd.dst.ca.us/areas/desert.htm>, 08/01/99.

<sup>25</sup> Metropolitan Water District of Southern California, 1996, "Integrated Resource Plan for Metropolitan's Colorado River Aqueduct Power Operations", 1996, p.5.

<sup>26</sup> Metropolitan Water District of Southern California, 1999, "Summary of Metropolitan's Power Operation". February, 1999, p.1, <http://aqueduct.mwd.dst.ca.us/areas/desert.htm>.

<sup>27</sup> Metropolitan Water District of Southern California, 1999, <http://www.mwd.dst.ca.us/pr/powres/summ.htm>. MWD provides further important system information as follows: Metropolitan owns and operates 305 miles of 230 kV transmission lines from the Mead Substation in southern Nevada. The transmission system is used to deliver power from Hoover and Parker to the CRA pumps. Additionally, Mead is the primary interconnection point for Metropolitan's economy energy purchases. Metropolitan's transmission system is interconnected with several utilities at multiple



interconnection points. Metropolitan's CRA lies within Edison's control area. Resources for the load are contractually integrated with Edison's system pursuant to a Service and Interchange Agreement (Agreement), which terminates in 2017. Hoover and Parker resources provide spinning reserves and ramping capability, as well as peaking capacity and energy to Edison, thereby displacing higher cost alternative resources. Edison, in turn, provides Metropolitan with exchange energy, replacement capacity, supplemental power, dynamic control and use of Edison's transmission system.

<sup>28</sup> SB 672, Machado, 2001. California Water Plan: Urban Water Management Plans. (The law amended Section 10620 of, and adds Section 10013 to, the Water Code) September 2001.

<sup>29</sup> SEC. 2. Section 10013 to the Water Code, 10013. (a) SB 672, Machado. California Water Plan: Urban Water Management Plans. September 2001, (Emphasis added.)

<sup>30</sup> California Department of Water Resources, 2005. California Water Plan Update 2005. Bulletin 160-05, California Department of Water Resources, Sacramento, CA.

<sup>31</sup> Metropolitan Water District of Southern California, 2000. *The Regional Urban Water Management Plan for the Metropolitan Water District of Southern California*, p.A.2-3.

<sup>32</sup> "About 1.36 maf per year (34 percent) of the region's average supply is developed locally using groundwater basins and surface reservoirs and diversions to capture natural runoff." Metropolitan Water District of Southern California, 1996, "Integrated Resource Plan for Metropolitan's Colorado River Aqueduct Power Operations", 1996, Vol.1, p.1-2.

<sup>33</sup> MWD estimates that reclaimed water will ultimately produce 190,000 AF of water annually. Metropolitan Water District of Southern California, 1999, "Fact Sheet" at: <http://www.mwd.dst.ca.us/docs/fcfsheet.htm>.

<sup>34</sup> Buros notes that "American government, through creation and funding of the Office of Saline Water (OSW) in the early 1960s and its successor organizations like the Office of Water Research and echnology (OWRT), made one of the most concentrated efforts to develop the desalting industry. The American government actively funded research and development for over 30 years, spending about \$300 million in the process. This money helped to provide much of the basic investigation of the different technologies for desalting sea and brackish waters." Buros, O.K., 2000. *The ABCs of Desalting. International Desalination Association*, Topfield, Massachusetts, p.5. This very useful summary is available at <http://www.ida.bm/PDFS/Publications/ABCs.pdf>

<sup>35</sup> Buros, O.K., 2000. *The ABCs of Desalting. International Desalination Association*, Topfield, Massachusetts, p.5. This very useful summary is available at <http://www.ida.bm/PDFS/Publications/ABCs.pdf> See also; Buros et al.1980. *The USAID Desalination Manual*. Produced by CH2M HILL International for the U.S. Agency for International Development.

<sup>36</sup> Wangnick,Klaus.1998 *IDA Worldwide Desalting Plants Inventory Report No.15*.Produced by Wangnick Consulting for International Desalination Association; and Buros, O.K., 2000. *The ABCs of Desalting. International Desalination Association*, Topfield, Massachusetts, p.5.

<sup>37</sup> Desalination systems with a unit size of 100 m3/d or more. Figures in original cited as 6,000 mgd.

<sup>38</sup> Wangnick Consulting GMBH (<http://www.wangnick.com>) maintains a permanent desalting plants inventory and publishes the results biennially in co-operation with the International Desalination Association, as the IDA Worldwide Desalting Plants Inventory Report. Thus far, fifteen reports have been published, with the latest report having data through the end of 1997; and see Wangnick,Klaus.1998 *IDA Worldwide Desalting Plants Inventory Report No.15*.Produced by Wangnick Consulting for International Desalination Association. The data cited are as of December 31, 1997.

<sup>39</sup> Cited in original as 9,400,000 m3/d.

<sup>40</sup> Wangnick,Klaus.1998 *IDA Worldwide Desalting Plants Inventory Report No.15*.Produced by Wangnick Consulting for International Desalination Association. (Cited in original in m3d (13,300,000 m3/d).

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<sup>41</sup> Wangnick, Klaus. 1998. *IDA Worldwide Desalting Plants Inventory Report No. 15*. Produced by Wangnick Consulting for International Desalination Association; and Buros, O.K., 2000. *The ABCs of Desalting, International Desalination Association*, Topfield, Massachusetts. The United States ranks second in over-all capacity (16 %) with most of the capacity in the RO process used to treat brackish water. The largest plant, at Yuma, Arizona, is not in use.

<sup>42</sup> Wangnick, Klaus. 1998. *IDA Worldwide Desalting Plants Inventory Report No. 15*. Produced by Wangnick Consulting for International Desalination Association; and Buros, O.K., 2000. *The ABCs of Desalting, International Desalination Association*, Topfield, Massachusetts.

<sup>43</sup> Salinity levels referenced in metric units.

<sup>44</sup> OTV. 1999. "Desalinating seawater." Memotechique, Planete Technical Section, No. 31 (February), p.1; and Gleick, Peter H. 2000. *The World's Water: 2000-2001*, Island Press, Covelo, p.94.

<sup>45</sup> Gerry Filteau, Separation Processes, Inc., 2386 Faraday Ave., Suite 100, Calsbad, CA 92008, [www.spl-engineering.com](http://www.spl-engineering.com)

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# Market Impact Analysis of Potential Changes to the ENERGY STAR<sup>®</sup> Criteria for Clothes Washers

## Background

Both the federal clothes washer standard and the ENERGY STAR clothes washer criteria changed on January 1, 2004. The federal standard changed by switching from a minimum Energy Factor of 2.50 to a minimum Modified Energy Factor (MEF) of 1.04<sup>1</sup>. The ENERGY STAR criteria for clothes washers changed from a minimum MEF of 1.26 to a minimum MEF of 1.42.

On January 1, 2007, the federal standard will increase again to an MEF of 1.26. With this, a change in the ENERGY STAR criteria may be necessary in order to maintain significant energy savings between ENERGY STAR qualified clothes washers and those that meet the federal standard. If changed, the objectives of the revised ENERGY STAR criteria would be to:

- Provide enough differentiation between ENERGY STAR qualified products and those that just meet the federal standard in order to protect the value of the ENERGY STAR brand.
- Provide an economic rationale for both consumers to invest and for utilities and other investors in ENERGY STAR promotions to demonstrate a public benefit associated with participation.
- Examine ways in which ENERGY STAR qualified models could produce significant water savings in order to attract the support of water utilities and other stakeholders interested in investing in water efficient products.

Several ENERGY STAR utility and regional efficiency partners have recommended including a maximum water factor requirement for ENERGY STAR qualified clothes washers. Currently, the ENERGY STAR criteria only set maximum consumption levels for energy. In some cases, an ENERGY STAR qualified clothes washer can use as much water as a non-qualified model. Adding a water factor requirement should assure that qualified models save both energy and water.

## Market Overview

Clothes washers have been included in the ENERGY STAR program since 1997. When the program first expanded to include clothes washers, there were very few qualified products available, with smaller European manufactured models producing the majority of qualified products. In June 1997, Maytag introduced the Neptune, a horizontal axis clothes washer. It was the first ENERGY STAR qualified clothes washer produced by one of the large U.S. manufacturers.

Until the introduction of the Neptune, ENERGY STAR qualified clothes washer market penetration was less than one percent. But after the introduction of the Neptune and other qualified models, market penetration increased to almost five percent. This success helped drive more clothes washer

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<sup>1</sup> MEF is an efficiency metric that accounts for projected dryer usage based on remaining moisture content (RMC). In order to derive the MEF, a new test procedure outlined in Appendix J1 to Subpart B of Part 430 in Title 10 of the Code of Federal Regulations (CFR) is used. The new test procedure, called the Appendix J1 test procedure, replaced the old Appendix J test procedure.



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manufacturers to produce and qualify new products, spurring utility and regional efficiency groups to offer rebates and incentive promotions on qualified washers. These activities resulted in an increase in the ENERGY STAR market penetration to its current level of nearly 28 percent.

On January 1, 2001, the ENERGY STAR criteria began using the MEF as defined in the Appendix J1 test procedure. Table One shows the change in average MEF level over time since the introduction of the Appendix J1 test procedure. The average MEF has risen substantially since the new test procedure took effect and there are many more qualified products above the average MEF. There was a slight dip in the average MEF due to the introduction of several new models at the minimum ENERGY STAR level in the first six months of 2004.

**Table One: Average MEF levels for ENERGY STAR qualified clothes washers by year**

<b>Date</b>	<b>Average MEF</b>	<b>Number of Qualified Products Above Average</b>
January 1, 2001	1.65	23
January 1, 2002	1.65	33
January 1, 2003	1.70	38
January 1, 2004	1.74	45
June 30, 2004	1.73	77

ENERGY STAR qualified clothes washers exist in both horizontal axis (front loading in most cases) and vertical axis (top loading) styles. Under the old Appendix J test procedure, it was virtually impossible to meet the ENERGY STAR criteria without using substantially less water than a non-qualified model since approximately 90% of the energy used by a clothes washer is used to heat the water. With the new Appendix J1 test procedure, the inclusion of dryer energy makes it possible for an ENERGY STAR qualified clothes washer to use almost as much energy and water as a non-qualified model as long as the remaining moisture content is very low. Models accomplish the low remaining moisture contents through very high spin speeds. These models will save substantial energy through shorter drying times, but the savings are only realized when the dryer energy is included.

## **Potential ENERGY STAR Criteria Performance Levels**

As of June 30, 2004, there are 171 ENERGY STAR qualified clothes washers and every leading manufacturer has several qualified products. Currently, the minimum ENERGY STAR MEF of 1.42 is 36% above the federal standard of 1.04. This criterion was set in order to attempt to capture approximately 25% of all available models. If ENERGY STAR wants to keep the criterion at a similar level above the 2007 federal standard and set it 36% above the federal standard, then ENERGY STAR would need to raise the MEF to 1.71. This MEF would include approximately half of all models that are currently qualified and approximately 25% of all models that are currently manufactured. Table Two provides a view on how the current qualified clothes washers fall under a range of MEF levels.

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**Table Two: ENERGY STAR and Federal Performance Levels – MEF Level Only**

<b>Minimum Modified Energy Factor (MEF)</b>	<b>Number of Qualified Products Available (as of June 30, 2004)</b>
1.42	171
1.55	116
1.60	109
1.65	100
1.70	84
1.71	82
1.75	69
1.80	64
2.00	23

With the addition of a water factor requirement (see Table Three), there would be fewer qualified models at each MEF level. Including a maximum water factor of 9.5 as part of the current ENERGY STAR criteria would cause 36 models to drop of the qualified product list. The initial water factor levels were drawn from the Consortium for Energy Efficiency (CEE) Clothes Washer High Efficiency specifications and supplemental levels were added. For water savings, a baseline water usage of 14,468 gallons of water was used based on the average water consumption of non-qualified products in the ENERGY STAR product database<sup>2</sup>. The average tub capacity was assumed to be 2.7 cubic feet.

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<sup>2</sup> D&R International.

**Table Three: Number of Qualified Products and Potential Savings at Various Levels – MEF and Water Factor**

Minimum Modified Energy Factor (MEF)	Maximum Water Factor	Qualified Products Available (as of June 30, 2004)	Average Volume (cubic feet)	Number of Original Equipment Manufacturers	Approximate Savings Compared to Federal Standard <sup>3</sup>		CEE Tier
					Electric (kWh/year)	Water (gallons per year)	
1.42	9.5	135	2.6	13	207	4,251	Tier 1
1.60	9.5	102	2.6	13	244	4,913	
1.60	8.5	82	2.6	11	244	5,485	Tier 2
1.60	7.5	63	2.6	10	244	6,270	
1.60	6.5	54	2.7	8	244	6,388	
1.70	9.5	77	2.6	12	255	5,245	
1.70	8.5	68	2.7	12	255	5,578	
1.70	7.5	56	2.6	9	255	6,244	
1.70	6.5	48	2.7	8	255	6,359	
1.71	9.5	75	2.6	12	257	5,231	
1.71	8.5	66	2.6	11	257	5,571	
1.71	7.5	54	2.6	10	257	6,261	
1.71	6.5	46	2.7	8	257	6,383	
1.80	9.5	61	2.6	10	262	5,640	
1.80	8.5	58	2.6	10	262	5,756	
1.80	7.5	50	2.6	9	262	6,256	Tier 3A
1.80	6.5	43	2.7	7	262	6,370	
1.80	5.5	34	2.9	5	262	6,702	Tier 3B
2.00	5.5	17	2.7	4	280	6,702	

## Engineering Considerations

According to the current testing procedure, the most efficient model in terms of Modified Energy Factor has an MEF of 2.66 and a water factor of 7.3. The top model with a water factor of less than 5.5 has an MEF of 2.2. Chart One on page 6 shows a regression analysis of MEF and water factor using all current ENERGY STAR qualified clothes washers. Water factor *tends* to decrease with

<sup>3</sup> D&R International.



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higher MEF values, but as the regression analysis shows, with the J1 test procedure, the correlation is not very strong and there are many exceptions. Therefore, raising the minimum MEF level to reduce water usage would not be an effective approach and a separate water factor requirement would be needed.

Each proposed performance level creates some technical limitations for a number of the manufacturing partners. Within the highest MEF level of 2.00, there is currently only one model manufactured by a major manufacturer<sup>4</sup>. This model has a water factor of 5.87, so it would not qualify for the highest level listed on table 3. The 1.8 MEF level and CEE's top tier of 3B currently feature models from two of the four major manufacturers. Each whole number drop in the maximum water factor saves approximately 1000 gallons of water per year per unit.

## Potential Energy Savings

Tables 4, 5, and 6 below show the estimated savings for three scenarios of raising the MEF requirement for ENERGY STAR. Each table assumes a 20% market penetration to show the potential national energy savings of an appropriate criteria change at the given MEF requirement. The first scenario outlines the impact of an ENERGY STAR MEF of 1.6, the second scenario shows an MEF of 1.7 and the third scenario shows an MEF of 1.8.

Full year 2003 shipments of 8.15 million units were used to estimate total clothes washer sales. The baseline kWh/year was determined based on a model meeting the 2007 federal minimum MEF of 1.26. The ENERGY STAR kWh/year assumes the average kWh/year for products currently above each level.

**Table 4: MEF of 1.6 and 20% ENERGY STAR Market Penetration Savings**

ENERGY STAR Shipments (20% penetration)	NAECA AEC (kWh/yr)	ENERGY STAR AEC (kWh/yr)	Savings/Unit (kWh/yr)	National Aggregate (MWh/yr)
1,629,160	463	219	244	397,515

**Table 5: MEF of 1.7 and 20% ENERGY STAR Market Penetration Savings**

ENERGY STAR Shipments (20% penetration)	NAECA AEC (kWh/yr)	ENERGY STAR AEC (kWh/yr)	Savings/Unit, kWh/yr	National Aggregate (MWh/yr)
1,629,160	463	208	255	415,436

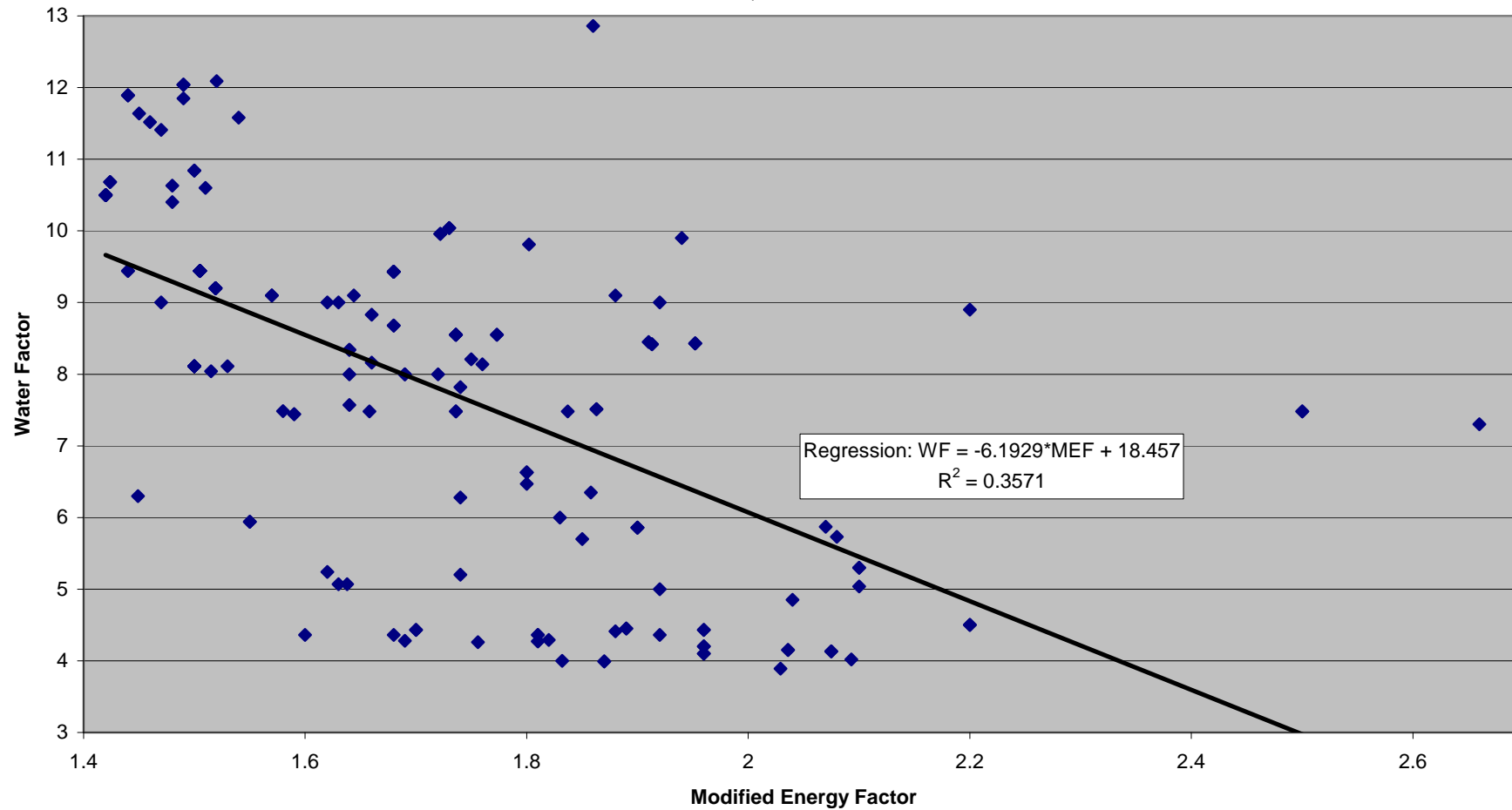
**Table 6: MEF of 1.8 and 20% ENERGY STAR Market Penetration Savings**

ENERGY STAR Shipments (20% penetration)	NAECA AEC (kWh/yr)	ENERGY STAR AEC (kWh/yr)	Savings/Unit, kWh/yr	National Aggregate (MWh/yr)
1,629,160	463	201	262	426,840

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<sup>4</sup> Major manufacturers are defined as Whirlpool, Maytag, GE Appliances and Electrolux since they control more than 99% of the United States market as of 2002 according to Appliance Magazine.

**Chart One: Correlation of Water Factor (WF) and Modified Energy Factor (MEF) for ENERGY STAR Qualified Clothes Washers**



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## Summary

Since the inclusion of clothes washers into the ENERGY STAR program, the Department of Energy has worked with stakeholders to insure the criteria continues to offer consumers significant energy savings while helping to encourage new energy efficient technologies into the appliance market place. This was once again achieved in 2004 when ENERGY STAR increased the criteria to 1.42 MEF causing many of the models with the highest water and energy usage to no longer qualify while maintaining a very healthy nationwide market share.

Reviewing potential clothes washer criteria offers an opportunity for stakeholders to comment on both energy and water efficiency possibilities. By discussing suitable MEF and water factor levels, utilities and other partners concerned about water usage could use the ENERGY STAR program as a way to promote the conservation of all resources. Moreover, the addition of a water factor requirement could allow for a more extensive partner network to include water utilities and provide an umbrella for which to promote resource efficient clothes washers. The Department of Energy looks forward to receiving all comments regarding this opportunity.

This analysis is based on an examination of currently available models and makes no attempt to predict technological advancements between now and 2007 when the Federal standard is increased. Manufacturers have over two years to meet the new Federal standard.

The Department of Energy will be hosting a public hearing to discuss all issues related to the ENERGY STAR clothes washer criteria on August 31, 2004 in Washington, DC. Any comments prior to this meeting can be submitted to Richard Karney at [Richard.Karney@EE.DOE.GOV](mailto:Richard.Karney@EE.DOE.GOV).